The Food Habits Database: an update, determination of sampling adequacy and estimation of diet for key species

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Abstract

Cook, A.M. and Bundy, A. 2010. The Food Habits Database: an update, determination of sampling adequacy and estimation of diet for key species. Can. Tech. Rep. Fish. Aquat. Sci. 2884: iv + 144p.

This report provides an update of the Maritimes Region Food Habits Database. Specific details are provided on improvements to the database, the numbers of fish stomachs examined and the adequacy of descriptions of prey breadth for each predator species using species accumulation curves. In addition, one method of diet estimation from length-stratified samples collected during a stratified random survey is described. The database consists of >156,000 stomachs for 68 predator species from 21 data sources focussed on NAFO division 4VWX, but does include limited information from NAFO divisions 3OP, 4T and 5YZ. Data spans four decades (1958-1969; 1981-1990, 1991-1998 and 1999-2008) with two species having data from all time periods (cod and haddock) and five more with data in three of four time periods. Predator species with >5000 stomachs include American plaice, Atlantic cod, haddock, pollock, redfish, silver hake, white hake, witch flounder and yellowtail flounder. Overall, results indicate that species accumulation curves are valuable in determining the adequacy of sampling for species within datasets, regions and time periods. Diets were estimated for 12 species whose species accumulation curve had reached a minimum rate of change ≤0.01.

Le présent rapport est une mise à jour de la base de données sur les habitudes alimentaires maintenue dans la région des Maritimes. Des détails sur les améliorations qui y ont été apportées, le nombre d'estomacs de poissons examiné et la suffisance des descriptions de la diversité des proies pour chaque espèce prédatrice reposant sur des courbes cumulatives spécifiques sont présentés. Une méthode d'estimation du régime alimentaire à partir d'échantillons structurés selon la longueur prélevés durant un relevé aléatoire stratifié est également décrite. La base de données se compose de plus de 156 000 estomacs d'individus appartenant à 68 espèces prédatrices provenant principalement de 21 sources de données dans les divisions 4VWX de l'OPANO, mais elle n'inclut pas les renseignements limités sur les divisions 3OP, 4T et 5YZ. Les données couvrent quatre décennies (1958-1969; 1981-1990, 1991-1998 et 1999-2008). Des données sur deux espèces (morue et aiglefin) sont disponibles pour ces quatre décennies, ainsi que sur cinq autres pour trois de ces quatre décennies. Les espèces prédatrices dont plus de 5 000 estomacs ont été prélevés incluent la plie canadienne, la morue franche, l'aiglefin, la goberge, le sébaste, le merlu argenté, la merluche blanche, la plie grise et la limande à queue jaune. En général, les résultats indiquent que les courbes cumulatives spécifiques sont utiles pour déterminer la suffisance de l'échantillonnage pour les espèces selon les ensembles de données, les régions et les décennies. Les régimes alimentaires de 12 espèces dont la courbe cumulative spécifique atteint un taux de changement minimum de ≤ 0,01 sont également estimés.

1. Overview

Monitoring what fish eat provides information on the interactions between species (who eats what and how much), how the ecosystem is structured, the degree of connectedness and the main energy pathways. It can be used to estimate predation mortality, consumption estimates for individual species and as input into ecosystem models. As DFO moves towards an ecosystem approach to fisheries, we are working to incorporate this information into our assessment of stock status and harvesting strategies.

Accurate representations of diet and consumption requires representative sampling across species' geographical range, time and life history stage, as diet can change spatially, temporally and with body size (Link and Garrison 2002). Spatial changes in diet may result from availability of prey items, but may also be related to other oceanographic features such as temperature, depth or habitat type. Temporal diet changes are observed at a range of time scales. On a daily basis many fish show diel feeding patterns, whereas seasonal and interannual changes in diet have also been observed. As fish grow, their prey field changes, since their mouth size increases, they swim faster and their distribution may change.

The stomach database is a compilation of the available food habits information collected over the past five decades for an array of fin fish species on the Scotian Shelf from a range of data sources.

1.1 Objectives

The objective of this Technical Report is to provide an updated overview of the Maritimes Region Food Habits Database, housed in the Population Ecology Division's Virtual Database. Specific details are provided on the numbers of stomachs examined and the adequacy of descriptions of prey breadth for each predator species through the generation of species accumulation curves. In addition, one method of diet estimation is described and several examples shown for species sampled during the DFO's summer research survey of 4VWX between 1995 and 2008.

1.2 History

The Food Habits Database was an outcome of the Comparative Dynamics of Exploited Ecosystems in the Northwest Atlantic project (CDEENA), a DFO Fisheries Strategic Science Fund program, 1999-2003. The broad goals of CDEENA were to explore the structure and functioning of eastern Canadian marine ecosystems, how they had changed over time and their subsequent effects on fish productivity. Food habits data were collected from DFO's Spring (NAFO Division 4VsW) and Summer (NAFO Division 4VWX) Research Surveys of the Scotian Shelf. In addition, information from extant stomach data sources, dating back to the 1950s were recovered from research papers, technical reports, old databases and in some cases, old stomachs preserved in formalin. Laurinolli et al. (2004) detailed the development of the database, its data sources, statistics on numbers of stomachs collected and provided estimates of fish diet up to year 2000. Several changes have occurred since that time (detailed below), requiring the update of the Laurinolli et al. (2004) report.

1.2.1. The stomach sampling protocol has changed

Fish stomachs were collected under the auspices of CDEENA from 1999-2002. The fish stomachs, or whole fish, were collected at sea, frozen, and then processed at the Bedford Institute of Oceanography (Laurinolli et al. 2004, App III). When the CDEENA project ended in 2003, no further food habits data was collected from the RV Surveys until 2005 due to the lack of alternate funds. At this time, the opportunity arose to initiate a stomach sampling at-sea program. A. Bundy was supported by the Population Ecology Division to conduct stomach sampling at sea on the second vessel of a comparative trawling exercise in 2005 (Clark 2005). Since then, the 'stomach sampling at sea' program has been conducted on the summer RV Survey each year. It is in the process of being established as part of the regular sampling on the Spring and Summer Research Surveys. See Appendix 1 for stomach sampling protocol.

1.2.2. Information has been added to the database

1.2.2.1 New data sources:

PB- Porbeagle shark data from commercial and research surveys in 1999-2001
SD- Shark derbies data containing diet information for fish collected during recreational fishing in 1999-2008
HSP- Hydroacoustic surveys for Pollock which sampled pollock with bottom trawls for ground truthing hydroacoustic results in 2002
SHS- Silver Hake Survey food habits data between 1981 and 1986
CMF- Long horn sculpin samples were collected during commercial fishing sets in St. Mary's Bay, NS

1.2.2.2 New data to existing data sources

Additional data for the Research Survey (GS) data source included missions numbers- NED2002040,NED2003003, NED2005001, NED2005002, NED2005027, TEL2005545, TEL2005546, NED2006002, NED2006030,NED2006031, NED2006036,TEL2006614, TEL2006615, TEL2007745, TEM2007685, TEM2007686, TEL2008805, TEM2008830, TEM2008875.

1.3 Stomach Database Schema

The information contained in the stomach database is derived from a variety of sources that have employed different sampling protocols and coding. The task of combining the data into a single database and providing sufficient information to allow researchers to make informed decisions on the suitability for specific analyses has been documented by Laurinolli et al. (2004). However, some improvements and changes have been made to the database since that time and an overview of the schema is provided below.

The Oracle database has three main production tables containing the details of the stomach samples (Figure 1.3.1). The outer SDINF table contains the set INFormation including the location, depth, date, temperature and gear (Table 1.3.1). The fish DETailed information in the SDDET contains the individual fish number, length, weight, stomach weight and fullness data (Table 1.3.2). The STOmach contents information is in the SDSTO table and contains the prey species identification, prey weight, length, count and level of digestion (Table 1.3.3). In addition, the database contains code tables for the three main tables. In each table DATASOURCE is described in the SDSOURCE table (Table 1.3.4). The GEAR column of the SDINF table is described in SDGEAR (Table 1.3.5). FULLNESS from the SDDET table is detailed in the SDFULLNESS table respectively (Table 1.3.6) and SPEC and PREYSPECCD are species research codes that are described in the PREY_SPEC_DETAILS table (Table 1.3.7) .Finally, DIGESTION from the SDSTO table is described in SDDIGEST (Table 1.3.8)

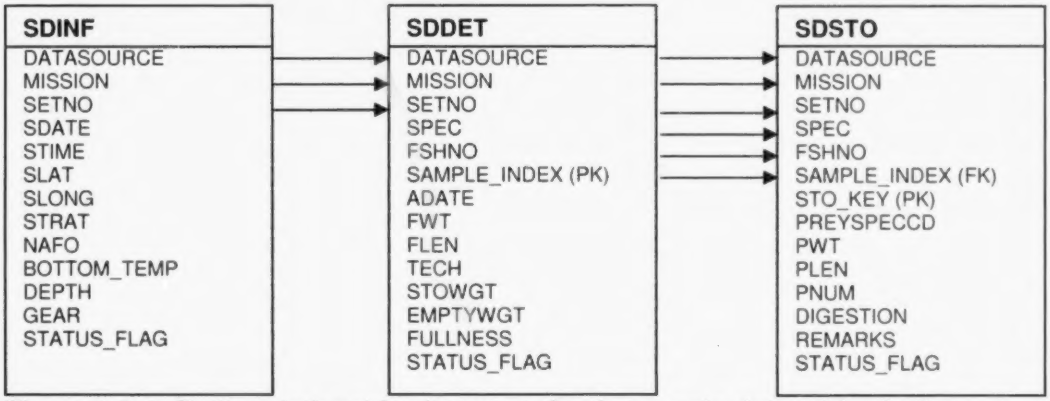
SDINF
DATASOURCE
MISSION
SETNO
SDATE
STIME
SLAT
SLONG
STRAT
NAFO
BOTTOM_TEMP
DEPTH
GEAR
STATUS_FLAG
SDDET
DATASOURCE
MISSION
SETNO
SPEC
FSHNO
SAMPLE_INDEX (PK)
ADATE
FWT
FLEN
TECH
STOWGT
EMPTYWGT
FULLNESS
STATUS_FLAG
SDSTO
DATASOURCE
MISSION
SETNO
SPEC
FSHNO
SAMPLE_INDEX (FK)
STO_KEY (PK)
PREYSPECCD
PWT
PLEN
PNUM
DIGESTION
REMARKS
STATUS_FLAG

Figure 1.3.1: Entity relationships between the three main data tables in the stomach database.

Table 1.3.1: Description of the SDINF table with the set information for stomach samples.

Column	Type	Size	Description
DATASOURCE	VARCHAR2	3	Trip type code
MISSION	VARCHAR2	15	Trip ID
SETNO	NUMBER	3	Set number
SDATE	DATE	7	Sampling date (YY-MM-DD)
STIME	NUMBER	4	Sampling time (24 hr)
SLAT	NUMBER		Set latitude (DDMM.MM)
SLONG	NUMBER		Set longitude (DDMM.MM)
STRAT	VARCHAR2	3	Stratum
NAFO	VARCHAR2	10	NAFO division
BOTTOM_TEMPERATURE	NUMBER	5.2	Water temperature (°C)
DEPTH	NUMBER	4	Bottom depth
GEAR	NUMBER	2	Sampling gear
STATUS_FLAG	NUMBER		Row status (0-valid; 1-Potential concerns)

Table 1.3.2: Description of the SDDET table with fish information for stomach samples.

Column	Type	Size	Description
DATASOURCE	VARCHAR2	3	Trip type code
MISSION	VARCHAR2	15	Trip ID
SETNO	NUMBER	3	Set number
SPEC	NUMBER	4	Species research code
ADATE	DATE		Analysis date (YY-MM-DD) for stomachs that were processed on land and no ADATE was present SDATE+365 was used
FSHNO	NUMBER	6	Individual fish number
SAMPLE_INDEX (PK)	NUMBER	6	Unique fish identifier
FWT	NUMBER	6.1	Fish weight
FLEN	NUMBER	4	Fish length
TECH	VARCHAR2	10	Stomach analysis tech code
STOWGT	NUMBER	5.1	Full stomach weight
EMPTYWGT	NUMBER	5.1	Empty stomach weight
FULLNESS	NUMBER	1	Stomach fullness code
STATUS_FLAG	NUMBER		Row status (0-valid; 1-Potential concerns)

Table 1.3.3: Description of the SDSTO table with the stomach contents details from sampled fish.

Column	Type	Size	Description
DATASOURCE	VARCHAR2	3	Trip type code
MISSION	VARCHAR2	15	Trip ID
SETNO	NUMBER	3	Set number
SPEC	NUMBER	4	Species research code
FSHNO	NUMBER	6	Individual fish number
SAMPLE_INDEX (FK)	NUMBER	6	Unique fish identifier
STO_KEY (PK)	ROWID	6	Generated identifier
PREYSPECCD	NUMBER	4	Prey species research code
PWT	NUMBER	10.4	Prey weight (g)
PLEN	NUMBER	5.1	Prey length (cm)
PNUM	NUMBER	6	Number of prey
DIGESTION	VARCHAR2	1	Digestion code (unknown coding in FEP and P70)
REMARKS	VARCHAR2	150	Prey comments
STATUS_FLAG	NUMBER		Row status (0-valid; 1-Potential concerns)

Table 1.3.4: SDSOURCE code table

Datasource	Description	Details
BB	BB Browns bank samples	All stomachs from one set on Browns Bank in 2000
CF	CF Condition Factor	Samples collected at port from commercial fishing trips
CI	CI Commercial Index- observer coverage	Part of 4VsW Sentinel long line survey
CMF	CMF Commercial Fishing	St. Mary's Bay longhorn sculpin
CS	CS Commercial Index Sampling	Part of 4VsW Sentinel long line survey
FEP	FEP Fisheries Ecology Program	Stomachs from 4X across all seasons
GPS	GPS Groundfish Port Samples	No location information
GS	GS Groundfish Survey	Spring and Summer RV surveys
HS	HS Halibut Survey-ISDB	Halibut industry long line surveys
HSP	HSP Hyrdoacoustic survey for pollock	Pollock stomach data from one mission
JSS	JSS Sentinel Survey-observer coverage	Part of 4VsW Sentinel long line survey
P70	P70 Pre-1970s Surveys	Exploratory survey designs
PB	PB Porbeagle Data	Samples from porbeagle fishery and a scientific cruise
POK	POK Pollock Survey	4WX5Z samples in Autumn
PS	PS Herring Survey	Several species sampled but only haddock and herring intensively
SD	SD Recreational shark derbies	Blue,porbeagle,thresher and mako sharks sampled dockside from rod and reel shark fishing
SHS	SHS Silver Hake Survey	Multiple surveys along shelf edge and across broad range of areas
SP	SP Juvenile fish survey	
SS	SS Sentinel Survey-ISDB	Part of 4VsW Sentinel long line survey
TIS	TIS Trawl Impact Study	Samples from 4TVW Closed haddock box- multiple tows over same location

Table 1.3.5: SDGEAR code table

Gear	Description
3	Yankee #36 otter trawl
4	#41.5 otter trawl
5	Long line
7	Midwater trawl
9	Western II A
11	Recreational angling
14	Campelen trawl

Table 1.3.6: SDFULLNESS code table

Fullness	Description
0	Empty
1	0-25% Full
2	25-50% Full
3	50-75% Full
4	75-100% Full
5	Everted
6	Regurgitated

Table 1.3.7: PREY_SPEC_DETAILS code table

Column	Type	Size	Description
SPECCD	NUMBER	4	Research code
PHYLUM	VARCHAR2	25	Species Phylum or generic unidentifiable name
CLASS1	VARCHAR2	25	Species Class
ORDER1	VARCHAR2	25	Species Order
FAMILY	VARCHAR2	25	Species Family
GENUS	VARCHAR2	25	Species Genus
SPECIES	VARCHAR2	25	Species
COMMON	VARCHAR2	25	Common name
CAT1	VARCHAR2	25	Grouping category 1- Species characteristic (large demersal, benthic invertebrate etc.)
CAT2	VARCHAR2	25	Grouping category 2-Loosely by Phylum (Fish, Arthropods, Molluscs etc.)
CAT3	VARCHAR2	25	Grouping category 3- Family grouping for fish, phylum for most others
FAM	VARCHAR2	25	Family grouping for all species

Table 1.3.8: SDDIGEST code table

Digestion	Description
1	Good condition
2	Partly digested
3	Well digested
4	Unidentifiable

1.3.1. Data consistency checks have been preformed and validation rules added

In addition to the new data sources and new data that have been added to the database since Laurinoll et al., (2004), rigourous consistency checks on the database have been preformed and validation rules added. In the process, data entry errors, duplicate entries, and missing information have been corrected through data editing and the consultation of paper data entry sheets. Further issues will be addressed as they arise. Some specific changes that have been made to improve the database and the consistency of the uploading process are detailed below.

1.2.3.1 Specific data sources

The Browns Bank survey, which was originally entered under the SP (Special Surveys) data source, with other independent surveys, is now contained within its own BB data source, to make it readily identifiable.

1.2.3.2 Added to Production Tables

A new column of fishing gear type was added to the SDINF table to allow for comparison of diets across fishing gear types.

1.2.3.3 Deleted From Production Tables

Several columns were removed from the SDSTO table as they were redundant. These columns included Preyitemcd, Preyitem, Preyspec, which are now represented in a new table PREY_SPEC_DETAILS.

1.2.3.4 Altered within Production Tables

The under utilized adate (analysis date) column in SDDET was populated with values for stomachs that were analyzed as either fresh 'at-sea' or preserved (either frozen or formaldehyde), by either the direct sample date (sdate) from the SDINF table or the sample_date+365d respectively. This allows for the selection of data from either fresh or frozen stomachs for comparison.

1.2.3.5 New Constraints

Primary key constraint was added to sample_index in the SDDET table and sto_key column of the SDSTO table. Not null constraint has been added to each of the columns listed in Table 1.2.1.

Table 1.2.1: Columns of Food habits database with not null constraint.

SDINF	SDDET	SDSTO
Datasource	Datasource	Datasource
Mission	Mission	Mission
Setno	Setno	Setno
	Spec	Spec
	Fshno	Fshno
	Sample_index	Sample_index
		Preyspec
		Sto_key

1.4 Status

The database consists of 156,277 stomachs for 68 predator species from 21 data sources focussed on NAFO division 4VWX, but does include limited information from NAFO divisions 3OP, 4T and 5YZ. Data spans four decades (1958-1969; 1981-1990, 1991-1998 and 1999-2008) with two species having data from all time periods (cod and haddock) and five more with data in three of four time periods (Table 1.4.1). Predator species with >5000 stomachs include American plaice, Atlantic cod, haddock, pollock, redfish, silver hake, white hake, witch flounder and yellowtail flounder. Fish with stomach contents in the SDSTO table account for 60% of the total number of stomachs examined, 34% of stomachs were empty, 3% were everted and 0.5% of stomachs were regurgitated.

There are 703 distinct prey items in the SDSTO table which represent 254 families in 22 phyla. Annelida, euphausiidae and arthropoda have the highest representation, each accounting for >7% of the 177,682 prey records in the database (Figure 1.4.1). Ammodytidae represent the fin fish species with the highest occurrence as prey with an overall frequency of 2.7% (Figure 1.4.1).

Table 1.4.1: Stomachs in the stomach database separated by species and time period.

	Time period				
Species	1958-1969	1981-1990	1991-1998	1999-2008	Total
ALEWIFE	277	3	0	1	281
AMERICAN PLAICE	5690	45	0	7887	13622
ARCTIC EELPOUT	8	0	0	0	8
ARGENTINE(ATLANTIC)	1026	38	0	256	1320
ATLANTIC SPINY LUMPSUCKER	10	0	0	0	10
BARNDOOR SKATE	215	0	0	3	218
BLACK DOGFISH	19	0	0	0	19
BLUE SHARK	0	0	0	1452	1452
BONAPARTIA PEDIOLOTA	771	0	0	0	771
BRILL/WINDOWPANE	4	0	0	0	4
BUTTERFISH	2	2	0	0	4
CAPELIN	0	0	0	998	998
COD(ATLANTIC)	21530	1306	1605	7553	31994
CUNNER	0	0	0	2	2
CUSK	626	3	0	158	787
DAUBED SHANNY	0	0	0	173	173
EELPOUT,NEWFOUNDLAND	0	0	0	25	25
EELPOUTS(NS)	35	0	0	0	35
FOURBEARD ROCKLING	10	3	0	0	13
GRAY'S CUTTHROAT EEL	11	0	0	0	11
HADDOCK	26384	4686	409	6361	37840
HALIBUT(ATLANTIC)	526	3	3	796	1328
HERRING(ATLANTIC)	562	1	0	3381	3944
HOOKEAR SCULPIN,ATL.	0	0	0	1	1
LAVAL'S EELPOUT	0	0	0	18	18
LITTLE SKATE	28	0	0	12	40
LONGFIN HAKE	152	4	0	261	417
LONGHORN SCULPIN	189	1	14	2684	2888
LUMPFISH	22	0	0	44	66
MACKEREL(ATLANTIC)	0	5	0	1097	1102
MAILED SCULPIN	1	0	0	0	1
MARLIN-SPIKE GRENADIER	74	0	0	125	199
MONKFISH,GOOSEFISH,ANGLER	262	39	0	688	989
NORTHERN HAGFISH	0	0	0	1	1
NORTHERN SAND LANCE	0	3	0	2008	2011
NORTHERN WOLFFISH	0	0	0	2	2
OCEAN POUT(COMMON)	0	0	0	322	322
OFF-SHORE HAKE	0	3	0	12	15
POLLOCK	2487	1063	3	1832	5385
PORBEAGLE,MACKEREL SHARK	0	0	0	1161	1161
RAINBOW SMELT	6	0	0	0	6
REDFISH UNSEPARATED	0	42	7	5511	5560
ROSEFISH(BLACK BELLY)	0	0	0	13	13
SEA RAVEN	51	0	0	1122	1173
SHAD AMERICAN	0	0	0	1	1
SHORTFIN MAKO	0	0	0	23	23
SHORTHORN SCULPIN	0	0	0	5	5
SHORTTAILED EELPOUT(VAHL)	0	0	0	651	651
SILVER HAKE	1179	2806	0	5389	9374
SMOOTH SKATE	95	1	0	611	707
SNAKE BLENNY	0	0	0	55	55
SPINY DOGFISH	147	310	0	1522	1979
SPOTTED WOLFFISH	23	0	0	4	27
SQUIRREL OR RED HAKE	26	105	0	1412	1543
STRIPED ATLANTIC WOLFFISH	76	0	0	690	766
SUMMER FLOUNDER	0	0	0	1	1
THORNY SKATE	999	3	0	2705	3707
THRESHER SHARK	0	0	0	4	4
TOMCOD(ATLANTIC)	0	0	0	1	1
TURBOT,GREENLAND HALIBUT	4	0	0	2141	2145
WHITE BARRACUDINA	0	0	0	2	2
WHITE HAKE	1236	811	31	3579	5657
WINTER FLOUNDER	244	10	0	876	1130
WINTER SKATE	380	0	0	699	1079

	Time period				
Species	1958-1969	1981-1990	1991-1998	1999-2008	Total
WITCH FLOUNDER	2721	12	0	2359	5092
WOLF EELPOUT	0	0	0	1	1
WOLFFISH,UNIDENT.	220	0	0	0	220
YELLOWTAIL FLOUNDER	3193	37	0	1828	5058
TOTAL	71521	11345	2072	70519	155457

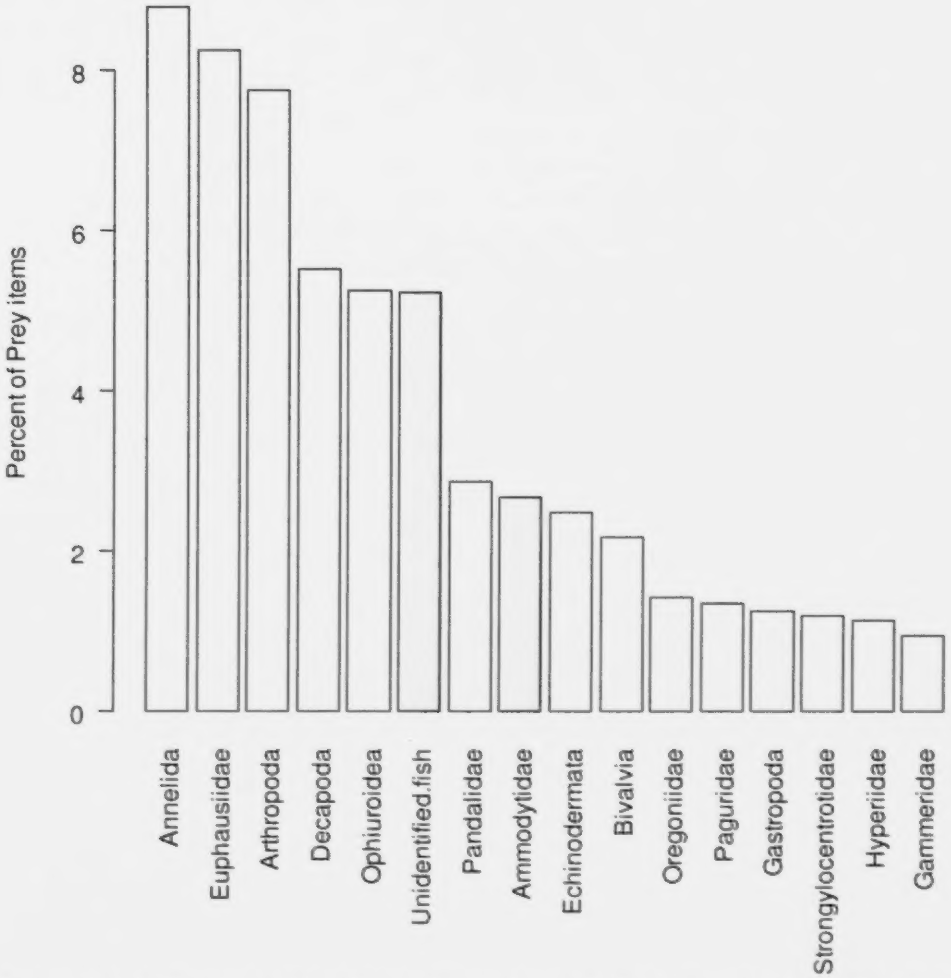

Figure 1.4.1: Percent of total prey items from all data sources from the stomach database organised by family (FAM) grouping. Yellow (light grey) shading represents invertebrates and green (dark grey) represents fin fish.

2. Methods

2.1 Adequacy of stomach sampling through species accumulation curves

We used species accumulation curves (SAC) to determine the adequacy of information to characterize the diet of predators, for each data source, predator species and region or time period (for sample sizes >15). The SAC plot compared the number of species observed against the measure of sampling effort, or in this instance, the number of prey items observed against the number of stomachs examined. The rate of 'new' prey items identified was the largest for the first several stomachs examined, which declined as more stomachs were examined since the incidence of unique prey items decreases. Eventually, this relationship reached an asymptote; indicating a low probability that novel prey items will be identified with the examination of additional stomachs and that the prey breath has been adequately defined. In cases where prey items are only identified to broad taxonomic levels, an asymptote may be reached at a low sample size, indicating that more effort needs to be directed toward prey identification for these groups. Generally, SAC's have been determined to have reached an asymptote through qualitative interpretation, i.e., visually (Link and Almeida 2000); however, we proposed a quantitative method. We calculated the minimum derivative of the curve, which was considered to have reached an asymptote when it dropped below 0.05.

SACs were generated in the R-project package vegan (Oksanen et al. 2009; R development core team 2009), using the random ordering method with 100 permutations. The plots produced depict the SAC and the confidence interval polygons. The family (FAM) prey grouping was selected to ensure consistency in describing the diet across predators since prey items are recorded at different levels of resolution. For example, fish are usually identified to the species level, whereas some invertebrates are only recorded at the family level.

2.2 Diet estimation

The diet information in the GS data source was collected as a length stratified sample from the spatially stratified random RV survey. Incorporating this information into the diet data to determine the population mean weighted estimate of food habits was done following the method described by Warren et al. (1994) which yields a mean and standard deviation of diet on a length stratified basis. Table 2.2.1 gives the notation for the formulae described below.

Table 2.2.1: Notation of variables used in the calculation of mean diet following the method of Warren et al. (1994).

Notation	Description
y_{ij}	Content of j^{th} fish in the i^{th} set within the strata
m_i	The number of fish sampled in the i^{th} set
M_i	The standardized number of fish caught in the i^{th} set
n	Number of sets within the stratum
$\bar{y}_i$	Mean content from the i^{th} set
w_h	Mean stratum content
s_h^2	Variance of stratum content
T_h	Setable units within a stratum
F_h	Estimated number of fish in stratum
v_h^2	Variance associated with F_h
W_h	Within strata total contents
S_h^2	Within strata variance of total contents
W	Combined strata total contents
S_w^2	Variance of combined strata contents
F	Combine strata number of fish
S_f^2	Variance of combined number of fish
C	Mean contents across a division
S_C^2	Variance estimator of the mean contents across a division

Initially we estimated the mean content weight within a single set for a single length group as;

$$\bar{y}_i = \frac{\sum_{j=1}^{m_i} y_{ij}}{m_i}$$

which was weighted by the total numbers caught of each length in each set to obtain a stratum mean:

$$w_h = \frac{\sum_n M_i \bar{y}_i}{\sum_n M_i}$$

whose variance was estimated by:

$$s_h^2 = \frac{1}{n\left(\frac{\sum_{i=1}^{n} M_i}{n}\right)^2} \frac{\sum_n M_i^2 (\bar{y}_i - \mu)^2}{n-1}$$

To combine strata we weight the within stratum contents by the estimated number of fish of the prescribed length within that stratum, which was calculated as:

$$F_h \frac{T_h \sum_{i=1}^{n} M_i}{n}$$

with a variance of:

$$v_h^2 = T_h^2 \frac{\sum_{i=1}^{n} M_i^2 - \frac{\left(\sum_{i=1}^{n} M_i\right)^2}{n}}{n(n-1)}$$

From this an estimator of the total stomach content of fish for each length group within the stratum was:

$$W_h = F_h w_h$$

with variance of:

$$S_h^2 = F_h^2 s_h^2 + w_h^2 v_h^2$$

Combining strata across a division (*L*) to determine the total and variance of contents was the summation of strata totals as:

$$W = \sum_{h=1}^{L} W_h \quad \text{and} \quad S_W^2 = \sum_{h=1}^{L} S_h^2$$

Similarly, we combined the total number of fish across a division as

$$F = \sum_{h=1}^{L} F_h \quad \text{and} \quad S_F^2 = \sum_{h=1}^{L} v_h^2$$

We obtained an estimator of the mean and variance of stomach contents for a specific length group within the division as:

$$C = \frac{W}{F}$$

$$S_C^2 = \frac{W^2}{F^2}\left(\frac{S_W^2}{W^2} + \frac{S_F^2}{F^2}\right)$$

The calculated mean and variance can be reported, or the mean can be converted to percent composition of diet weights as:

$$\%C_i = \frac{C_i}{\sum C_i} \times 100$$

3. Data sources

3.1 Groundfish research surveys (GS) - 1995-present

Stomachs were collected during the Summer (RV) survey of NAFO Divisions 4VWX and the Spring (RV) survey of NAFO Divisions 4VsW. Both surveys were stratified random designs with strata based on depth for RV or historic cod densities for 4VsW (Halliday and Koeller 1981; Gavaris and Smith 1987; Figure 3.1.1- 3.1.2). All surveys used the Western IIA bottom trawl. The protocol for stomach sampling since 2005, with minor updates in 2008 was detailed in Appendix 1. For each survey, fish stomachs were collected on a length stratified basis (see Protocols- Appendix 1). Mackerel and herring were frozen whole for detailed sampling at either the Maurice Lamontagne Institute or St. Andrew's Biological Station respectively. Between 1995 and 2003 stomach fullness was visually inspected and those with contents were individually frozen in brine for analysis at the Bedford Institute of Oceanography (BIO) by FSRS technicians (Fishermen-Scientists Research Society). In most cases empty stomachs were not collected or examined, but are included in the SDDET table with appropriate fullness codes. In 2005 an 'at-sea' stomach contents analysis program was initiated. All non-everted stomachs (including those designated as empty) were collected, opened and analysed by a designated stomach sampler. Stomachs that were not processed at sea (either due to time or weather constraints) were frozen and returned to BIO for processing. Additional samples were collected in Spring 2005 on Georges Bank (NAFO division 5Z) and in 2008 from NAFO division 4X (Figure 3.1.5; 3.1.6).

To date, the stomach analysis information moves through several forms prior to entry into the database. During analysis, information was hand written on data sheets, which were then keypunched to Microsoft Excel tables and finally uploaded to Oracle edit tables and error checked. Currently, a Microsoft Access database has been developed to reduce some of the potential data entry errors and includes several consistency checks and constraints (brief details in Appendix 1). From the stomach entry database, information is uploaded to Oracle edit tables through the ODBC for final editing prior to entry into the production tables.

References

Gavaris, S. and S.J. Smith. 1987. Effect of allocation and stratification strategies on precision of survey abundance estimates for Atlantic cod (*Gadus morhua*) on the eastern Scotian Shelf. Journal of the Northwest Atlantic Fisheries Science. 7:137-144.

Halliday, R.G. and P.A. Koeller, 1981. A history of Canadian groundfish trawling and data usage in ICNAF Divisions 4TVWX. In: Bottom trawl surveys, W.G. Doubleday and D. Rivard (eds.). Canadian Special Publications of Fisheries and Aquatic Sciences. 58:27-41.

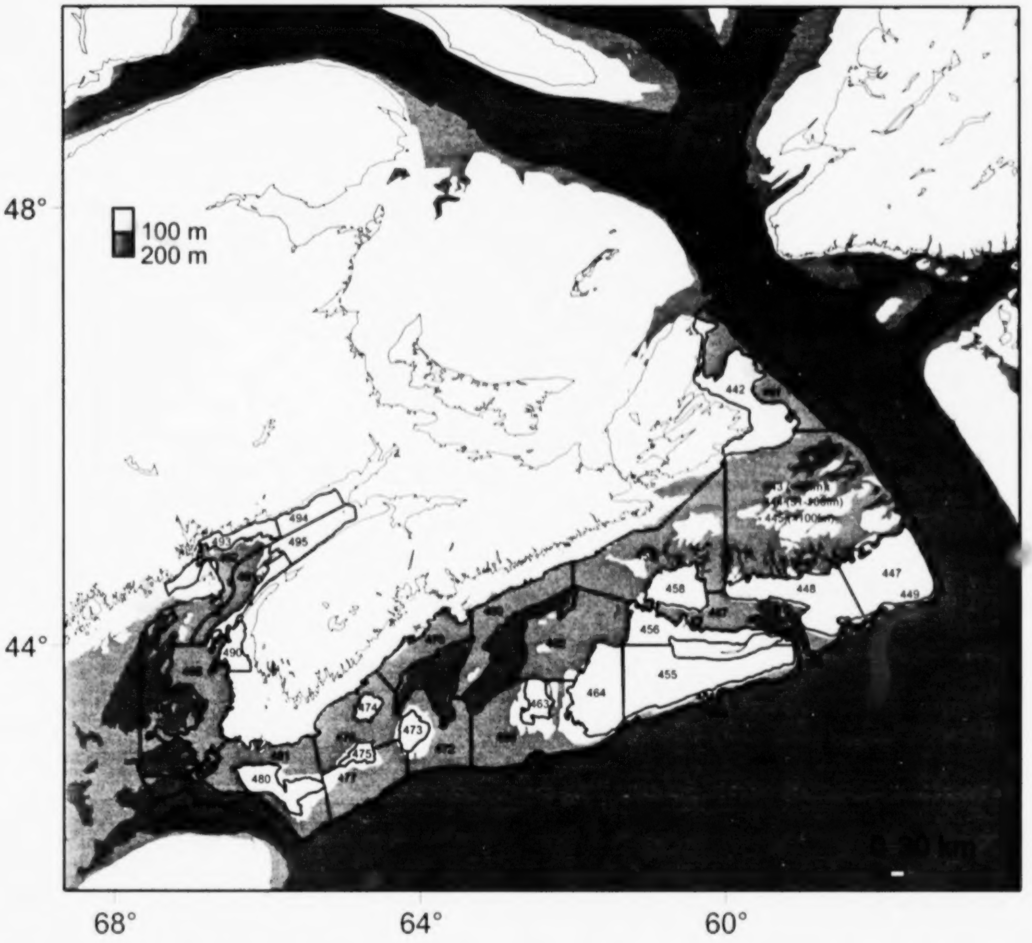
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Figure 3.1.1: Map of the summer RV survey strata.

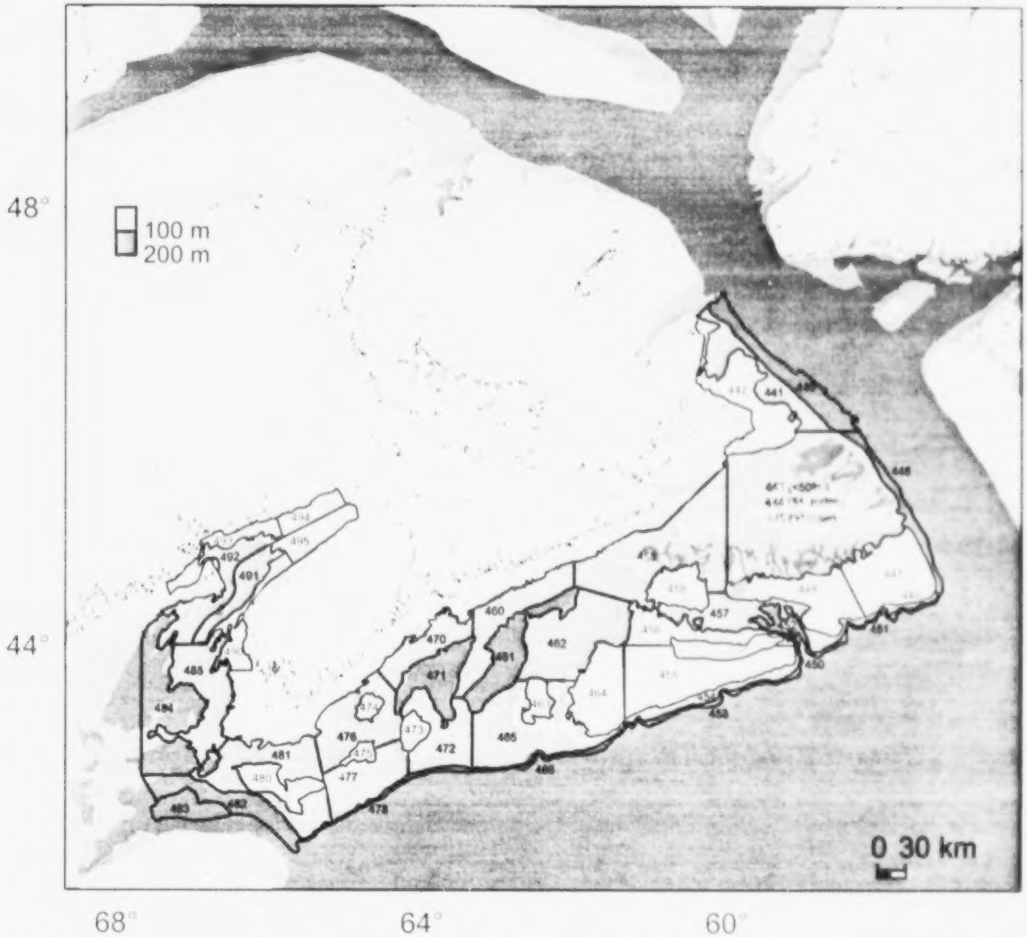
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Figure 3.1.1: Map of the summer RV survey strata.

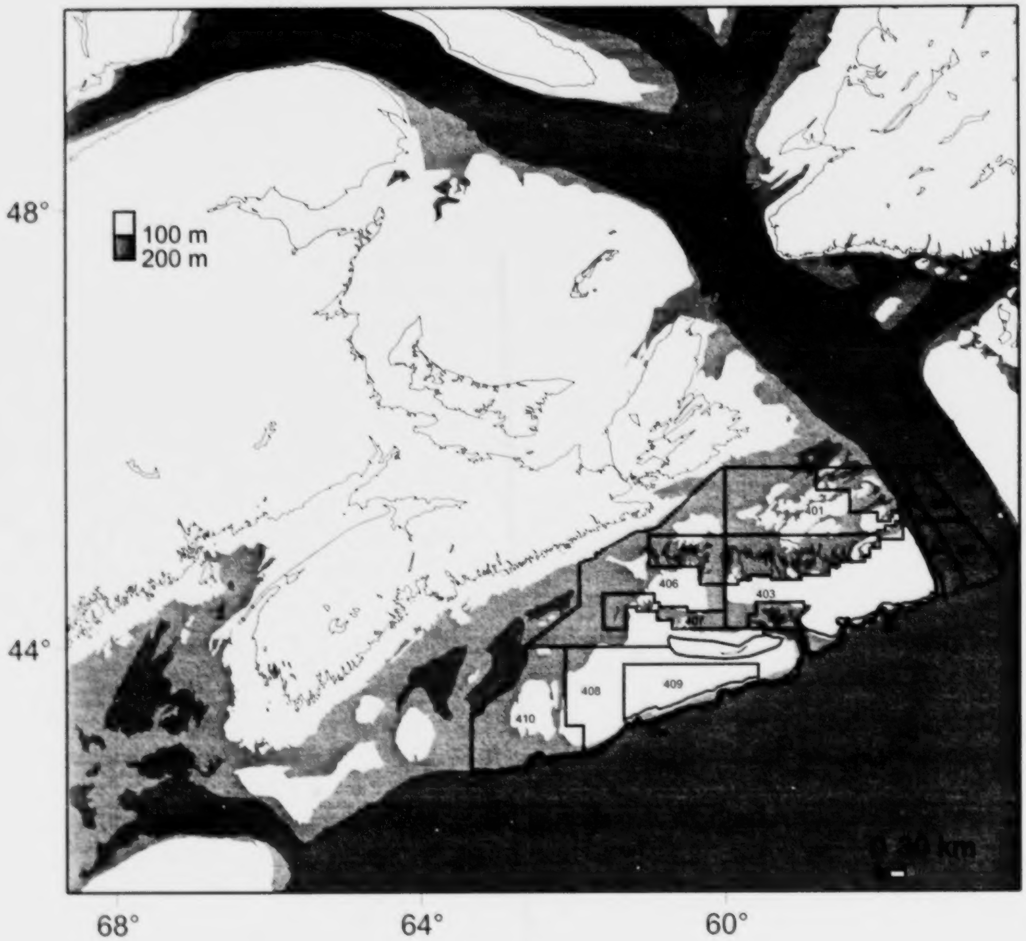
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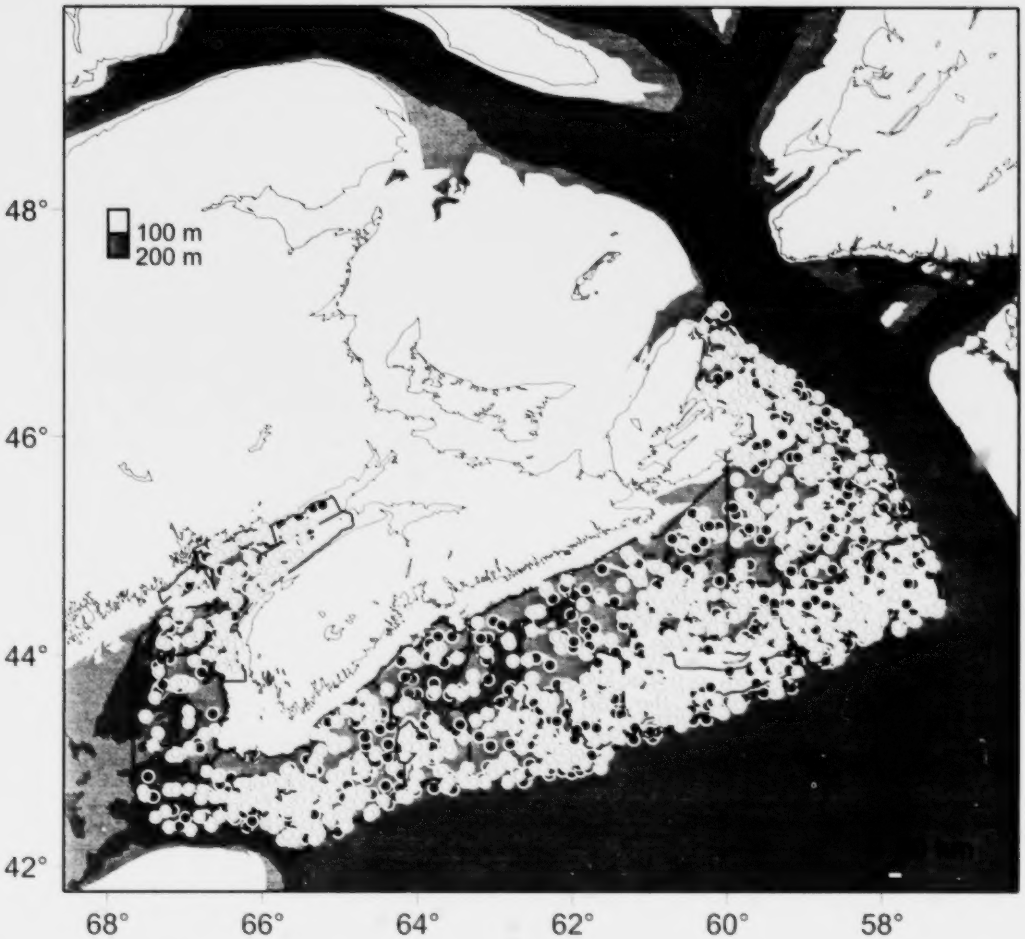
Figure 3.1.2: Map of strata locations from the 4VsW RV survey.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64°
62°
60°
58°
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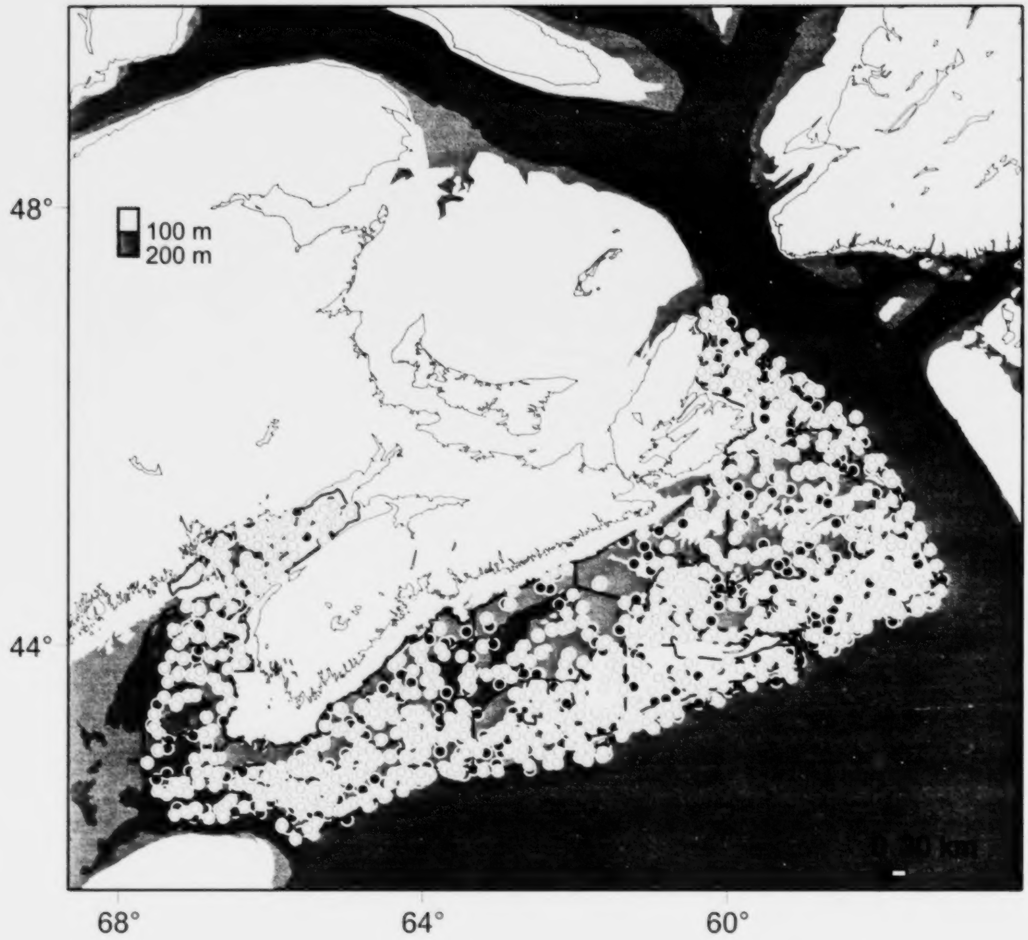
Figure 3.1.3: Map of set locations where stomachs were collected during the summer RV survey 1995-2001(white circles) overlaid on the sets from the summer RV survey (black circles). Black lines represent strata boundaries.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64°
60°
100 m
200 m
0 30 km

Figure 3.1.4: Map of set locations where stomachs were collected during the summer RV survey 2002-2008(white circles) overlaid on the sets from the summer RV survey (black circles). Black lines represent strata boundaries.

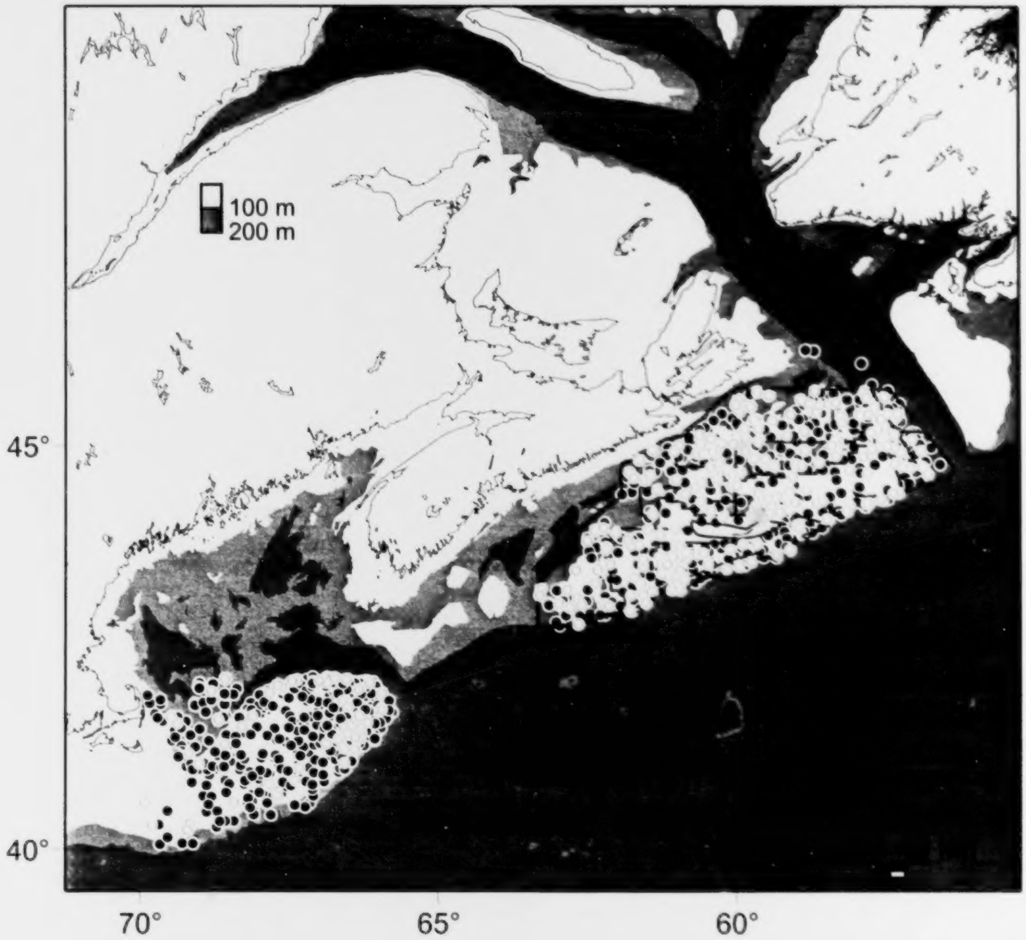


Figure 3.1.5: Locations of stomach samples collected during spring 4VsW survey and Georges bank between 1995-2001 are shown as white circles; black circles represent the set locations for the full RV surveys. Black lines represent 4VsW strata boundaries.

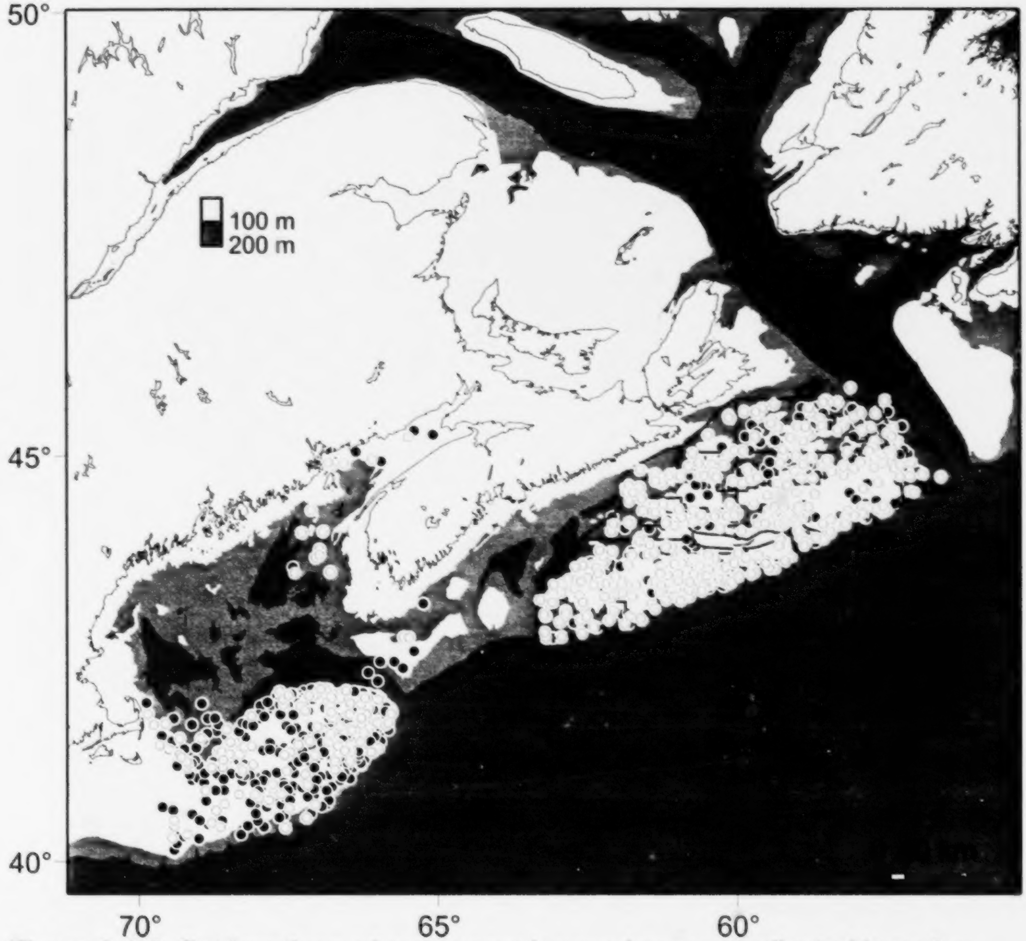


Figure 3.1.6: Set locations where stomach samples were collected in spring 4VsW survey and George's Bank-4X between 2002-2008 (white circles) overlaid on the locations of all sets from both surveys (black circles). Map depicts 564 sets. Black lines represent 4VsW strata boundaries.

3.1.1 Summary of GS data

Since 1999 we have sampled more than 68% of sets during both the Spring and Summer surveys (Table 3.1.1). The highest proportion of sampling occurred during the CEEDNA project between1999-2003 for both survey series. From 2004 onward there has been a decrease in proportion of sampling during Spring surveys; however Summer has remained consistently well sampled (Figure 3.1.3-3.1.4).

In total, 60,792 stomachs from 47 species have been sampled, 38,168 in the Summer and 22,624 in Spring (Tables 3.1.2; 3.1.3). Most of the abundant species were well sampled throughout the time period. Of the 47 species, 29 had sufficient sample sizes to be analysed with species accumulation curves to determine if sampling intensity has been sufficient to describe their diet. The species accumulation curves of 23 species fall below the critical rate of change of 0.05, with 13 being at or below 0.01. These results are further broken down by time period and region in Table 3.1.4.

The prey represented in the GS data source total 245 species which represent 114 family groups in 16 phyla. Of the fish species in the dataset 78% are detailed to the species level whereas 32% of invertebrates are identified to species.

Table 3.1.1: Frequency and percent of total sets in which stomach sampling occurred for the Spring and Summer RV Surveys.

		Spring			Summer	
Year	Survey Sets	Stomach Sampled Sets	Percent	Survey sets	Stomach Sampled Sets	Percent
1995	168	1	0.6	157	3	1.9
1996	52	.	.	201	77	38.3
1997	115	.	.	202	24	11.9
1998	.	.	.	193	.	.
1999	109	2	1.8	196	196	100.0
2000	116	114	98.3	219	218	99.5
2001	90	89	98.9	207	198	95.7
2002	121	119	98.3	214	175	81.8
2003	108	98	90.7	222	.	.
2004	.	.	.	192	.	.
2005	105	67	63.8	197	186	94.4
2006	108	96	88.9	215	179	83.3
2007	84	23	27.4	180	179	99.4
2008	92	30	32.6	170	161	94.7
Total	1268	639	50.4	2765	1596	57.7
Total since 1999	933	638	68.4	2012	1492	74.2

Table 3.1.2: Count of stomach samples from Spring RV surveys.

	Spring											
Species	1995	1996	1999	2000	2001	2002	2003	2005	2006	2007	2008	Total
AMERICAN SHAD	.	.	.	.	.	.	.	.	1	.	.	1
AMERICAN_PLAICE	.	.	.	1244	697	1057	305	.	72	.	.	3375
ARGENTINE(ATLANTIC)	.	.	.	30	18	14	.	2	.	.	.	64
ATLANTIC_WOLFFISH	.	.	.	35	13	13	.	10	3	.	.	74
BARNDOOR_SKATE	.	.	.	.	.	.	.	3	.	.	.	3
CAPELIN	.	.	.	172	273	238	32	17	.	.	.	732
COD(ATLANTIC)	3	.	.	294	181	176	99	315	78	.	.	1146
CUNNER	.	.	.	.	.	.	.	1	.	.	.	1
CUSK	.	.	.	5	.	.	.	3	3	.	.	11
DAUBED_SHANNY	.	.	.	.	.	107	7	.	.	.	.	114
EELPOUT(VAHL)	.	.	.	125	109	47	2	11	13	.	.	307
EELPOUT_NEWFOUNDLAND	.	.	.	.	.	2	3	.	.	.	.	5
GREENLAND_HALIBUT	.	.	.	306	273	204	83	25	46	.	.	937
HADDOCK	.	.	.	670	404	25		14	.	.	.	1113
HALIBUT(ATLANTIC)	.	.	.	30	19	34	24	27	48	.	.	182
HERRING(ATLANTIC)	.	.	.	5	617	408	40	207	274	320	346	2217
LAVALS EELPOUT	.	.	.	.	.	13	.	.	.	.	.	13
LITTLE SKATE	.	.	.	1	.	.	.	.	.	.	.	1
LONGFIN_HAKE	.	.	.	.	.	114	.	.	3	.	.	117
LONGHORN_SCULPIN	.	4	.	186	179	217	236	347	57	.	.	1226
LUMPFISH	.	.	.	11	2	8	.	.	.	.	.	21
MACKEREL(ATLANTIC)	.	.	143	195	639	.	4	2	17	.	.	1000
MARLIN-SPIKE_GRENADIER	.	.	.	.	.	98	1	.	.	.	.	99
MONKFISH	.	.	.	38	20	46	13	12	14	.	.	143
NORTHERN_SAND_LANCE	.	.	.	140	291	250	11	29	2	.	.	723
OCEAN_POUT(COMMON)	.	.	.	9	.	8	3	50	.	.	.	70
POLLOCK	.	.	.	52	65	33	.	1	5	.	.	156
REDFISH_UNSEPARATED	.	.	.	604	375	508	250	7	52	.	.	1796
ROSEFISH(BLACK_BELLY)	.	.	.	.	.	.	.	.	1	.	.	1
SEA_RAVEN	.	.	.	18	17	59	47	108	26	.	.	275
SHORTHORN_SCULPIN	.	.	.	1	.	.	.	.	.	.	.	1
SILVER_HAKE	.	.	.	531	476	461	428	.	20	.	.	1916
SMOOTH SKATE	.	.	.	124	29	65	94	5	2	.	.	319
SNAKE_BLENNY	.	.	.	.	.	11	.	.	.	.	.	11
SPINY_DOGFISH	.	.	.	116	8	84	25	46	3	.	.	282
SQUIRREL_OR_RED_HAKE	.	.	.	31	73	92	79	.	18	.	.	293
SUMMER FLOUNDER	.	.	.	.	.	.	.	1	.	.	.	1
THORNY_SKATE	.	.	.	501	263	330	315	57	14	.	.	1480
WHITE_BARRACUDINA	.	.	.	.	.	2	.	.	.	.	.	2
WHITE_HAKE	.	.	.	344	202	332	161	41	61	.	.	1141
WINTER SKATE	.	.	.	49	29	81	101	3	1	.	.	264
WINTER_FLOUNDER	.	.	.	11	.	8	11	.	9	.	.	39
WITCH_FLOUNDER	.	.	.	677	.	.	.	1	1	.	.	679
WOLF_EELPOUT	.	.	.	.	.	1	.	.	.	.	.	1
YELLOWTAIL_FLOUNDER		.	.	272	.	.	.	.	.	.	.	272
Total	3	4	143	6827	5272	5146	2374	1345	844	320	346	22624

Table 3.1.3: Count of stomach samples from Summer RV surveys.

	SUMMER											
Species	1995	1996	1997	1999	2000	2001	2002	2005	2006	2007	2008	TOTAL
ALEWIFE	.	.	.	.	.	.	1	.	.	.	.	1
AMERICAN_PLAICE	.	.	.	1584	1263	.	.	224	66	397	382	3916
ARGENTINE(ATLANTIC)	.	.	.	56	63	44	.	6	3	14	6	192
ATLANTIC TOMCOD	.	.	.	.	.	.	.	.	.	.	1	1
ATLANTIC_WOLFFISH	.	.	.	88	86	90	113	33	13	30	42	495
CAPELIN	.	.	.	85	30	129	.	.	.	16	6	266
COD(ATLANTIC)	23	546	105	711	717	576	681	254	159	274	232	4278
CUNNER	.	.	.	.	.	.	.	.	.	1	.	1
CUSK	.	.	.	9	15	16	14	25	3	11	.	93
DAUBED_SHANNY	.	.	.	.	.	.	2	.	3	30	24	59
EELPOUT(VAHL)	.	.	.	111	58	89	.	30	19	26	10	343
EELPOUT_NEWFOUNDLAND	.	.	.	.	.	.	.	.	1	11	8	20
GREENLAND_HALIBUT	.	.	.	278	238	251	.	96	39	93	77	1072
HADDOCK	.	.	.	1270	1609	36	.	.	8	413	458	3794
HALIBUT(ATLANTIC)	.	.	.	28	23	42	41	52	48	74	64	372
HERRING(ATLANTIC)	.	.	.	232	19	144	.	80	171	380	.	1026
HOOKEAR_SCULPIN_ATL.	.	.	.	.	.	.	.	.	.	.	1	1
LAVALS EELPOUT	.	.	.	.	.	.	.	.	.	1	4	5
LITTLE SKATE	.	.	.	4	1	.	.	.	1	1	4	11
LONGFIN_HAKE	.	.	.	.	.	.	.	24	18	33	69	144
LONGHORN_SCULPIN	.	10	.	354	284	153	.	93	60	169	114	1237
LUMPFISH	.	.	.	6	1	3	.	5	.	.	8	23
MACKEREL(ATLANTIC)	.	.	.	6	5	25	.	1	.	.	.	37
MARLIN-SPIKE_GRENADIER	.	.	.	.	.	.	.	.	.	14	12	26
MONKFISH	.	.	.	99	108	73	91	56	32	39	41	539
NORTHERN WOLFFISH	.	.	.	2	.	.	.	.	.	.	.	2
NORTHERN_HAGFISH	.	.	.	.	.	.	.	.	.	1	.	1
NORTHERN_SAND_LANCE	.	.	.	232	469	438	.	.	8	83	45	1275
OCEAN_POUT(COMMON)	.	.	.	82	47	34	.	37	22	28	.	250
OFF-SHORE_HAKE	.	.	.	4	.	.	.	1	3	.	4	12
POLLOCK	.	.	.	251	304	239	.	72	26	87	92	1071
REDFISH_UNSEPARATED	.	.	.	989	653	826	.	205	152	245	466	3536
ROSEFISH(BLACK_BELLY)	.	.	.	7	.	.	.	.	.	.	5	12
SEA_RAVEN	.	.	.	106	103	88	133	119	71	94	126	840
SHORTHORN_SCULPIN	.	.	.		1	.	.	1	.	1	1	4
SILVER_HAKE	.	.	.	927	914	798	6	91	38	294	336	3404
SMOOTH SKATE	.	.	.	77	26	34	82	7	8	28	26	288
SNAKE_BLENNY	.	.	.	.	.	.	1	.	.	35	8	44
SPINY_DOGFISH	.	.	.	374	201	27	344	53	26	107	77	1209
SPOTTED_WOLFFISH	.	.	.	.	2	.	.	1	.	.	1	4
SQUIRREL_OR_RED_HAKE	.	.	.	234	114	254	238	39	7	90	115	1091
THORNY_SKATE	.	.	.	341	195	265	.	22	49	138	126	1136
WHITE_HAKE	.	.	.	433	505	323	407	154	112	175	174	2283
WINTER SKATE	.	.	.	66	52	58	83	9	3	16	33	320
WINTER_FLOUNDER	.	.	.	101	194	.	235	33	40	74	128	805
WITCH_FLOUNDER	.	.	.	612	488	.	.	.	.	3	56	1159
YELLOWTAIL_FLOUNDER	.	.	.	593	758	.	.	.	1	.	118	1470
TOTAL	23	556	105	10352	9546	5055	2472	1823	1210	3526	3500	38168

Table 3.1.4: Results of species accumulation curves for species collected during spring and summer RV surveys. For each region, period, season and species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves (shown in Appendix 3-GS).

Region	4VWX5Z			4VW												4X					
Period	1995-2008			1995-2001						2002-2008						1995-2001			2002-2008		
Season	All			Summer			Spring			Summer			Spring			Summer			Summer		
Species	n	min.	nprey	n	min.	nprey	n	min.	nprey	n	min.	nprey	n	min.	nprey	n	min.	nprey	n	min.	nprey
American plaice	1589	0.01	59	799	0.01	45	166	0.05	26	392	0.03	38	84	0.08	16	40	0.22	19	105	0.06	25
Atlantic cod	3896	0.004	85	1241	0.006	49	227	0.05	35	721	0.02	56	187	0.07	34	729	0.01	52	493	0.03	57
Atlantic halibut	320	0.05	43	17	0.4	12	17	0.52	14	75	0.13	24	60	0.12	20	23	0.17	11	123	0.11	30
Atlantic herring	1132	0.004	20	108	0.04	10	136	0.01	7	181	0.001	9	389	0.01	12	32	0.06	7	119	0.02	9
Atlantic wolfish	196	0.06	36	68	0.07	23	15	0.46	12	52	0.08	18	2	.	2	17	0.29	16	41	0.31	22
Capelin	359	0.01	14	55	0.04	7	170	0.01	8	13	0.07	5	121	0.01	8	.	.	.	.	.	.
Daubed shanny	39	0.05	10	.	.	.	.	.	.	39	0.05	10	.	.	.	.	.	.	.	.	.
Greenland halibut	745	0.02	41	270	0.04	27	173	0.02	20	142	0.08	23	102	0.05	14	1	.	1	9	0.11	3
Haddock	2966	0.003	75	960	0.01	53	629	0.01	44	315	0.03	46	13	0.31	6	614	0.02	48	421	0.02	50
Longhorn sculpin	1181	0.02	68	271	0.03	36	222	0.06	33	76	0.09	23	140	0.04	24	81	0.12	23	203	0.07	37
Mackerel	763	0.01	16	12	0.01	3	288	0.01	10	1	.	1	9	0.21	4	.	.	.	.	.	.
Monkfish	247	0.02	24	47	0.17	18	23	0.3	11	50	0.06	13	36	0.08	9	33	0.15	13	52	0.1	14
Ocean pout	101	0.13	34	15	0.33	11	1	.	1	8	0.86	11	3	.	2	14	0.49	13	46	0.28	25
Pollock	657	0.02	41	161	0.02	24	42	0.05	7	59	0.05	13	7	0.56	5	221	0.04	28	166	0.04	22
Red hake	331	0.06	45	67	0.15	21	8	0.11	2	64	0.17	23	15	0.4	8	61	0.1	22	116	0.05	22
Redfish	788	0.02	33	165	0.02	12	108	0.04	11	98	0.03	14	7	0.28	4	121	0.04	11	217	0.02	17
Sandlance	569	0.01	17	257	0.02	14	213	0.004	6	55	0.04	8	29	0.1	7	.	.	.	9	0.32	4
Sea raven	407	0.04	46	63	0.11	18	14	0.28	9	91	0.12	23	40	0.2	16	24	0.33	15	131	0.08	27
Silver hake	1581	0.006	34	672	0.01	27	191	0.02	12	163	0.02	21	94	0.03	11	265	0.02	17	194	0.03	20
Smooth skate	253	0.04	34	32	0.21	17	65	0.09	14	56	0.07	16	29	0.17	11	25	0.19	15	45	0.2	20
Snake blenny	35	0.08	10	.	.	.	.	.	.	35	0.08	10	.	.	.	.	.	.	.	.	.
Spiny dogfish	496	0.03	45	32	0.25	16	60	0.1	15	14	0.21	7	27	0.15	7	130	0.08	26	208	0.07	31
Thorny skate	1129	0.01	59	328	0.02	31	250	0.04	28	196	0.04	30	189	0.02	18	58	0.1	25	81	0.12	26
Vahl's eelpout	165	0.06	21	67	0.09	15	65	0.05	10	28	0.18	10	5	0.58	4	.	.	.	.	.	.
White hake	1318	0.01	55	305	0.04	36	126	0.08	25	220	0.01	27	128	0.07	24	171	0.08	30	359	0.04	36
Winter flounder	412	0.03	43	76	0.05	14	2	.	3	48	0.08	15	3	.	4	60	0.03	14	224	0.05	36
Winter skate	157	0.06	29	22	0.23	11	27	0.22	12	9	0.21	5	40	0.12	13	10	0.39	8	46	0.17	21
Witch flounder	863	0.01	30	465	0.02	26	303	0.01	14	28	0.25	12	.	.	.	48	0.12	12	14	0.14	5
Yellowtail flounder	833	0.01	39	596	0.01	31	91	0.05	12	75	0.13	22	.	.	.	54	0.04	11	17	0.29	8

3.2 Pre- 1970's Surveys (P70)- 1958-1969

The pre-1970's surveys were conducted from 1958 to 1969 to increase biological knowledge on distribution and stock delineation of both exploited and unexploited fishes (Halliday and Koeller 1981). These surveys occurred seasonally with varying geographic coverage but focussed on NAFO Divisions 4TVWX. There was no standard survey design for this data source, and the distribution of sets within a time period or mission was patchy. The majority of sets used either Yankee #36 or #41.5 otter trawls; however, fish from several long line sets were included. Stomach sampling was performed at sea during standard age-length sampling.

Prey items were identified to the highest degree of taxonomic detail possible. Contents were recorded as volumes by either comparison with standardized volumetric cylinders or by displacement in water. When more than one prey item was present, proportional contribution of each item was estimated and the actual volume calculated later (Kohler and Fitzgerald 1969). Not all prey item codes are the same as those currently used, however, most items can be converted to current codes using the PREY_ITEM_DETAILS table. 2050 records from the P70 data source have fullness codes of 1, 2, 3, or 4 and no corresponding SDSTO entries.

References

Branton R., K. Zwanenburg and Joann Smith DDA Computer Consultants. 2000. Pre 70 groundfish research trawl database "draft development plan". Department of Fisheries and Oceans, Virtual Data Centre.

Kohler, A.C. and D.N. Fitzgerald. 1969. Comparisons of food of cod and haddock in the Gulf of St. Lawrence and on the Nova Scotia banks. Journal of the Fisheries Research Board of Canada. 26:1273-1287.

3.2.1 Summary of P70 data

The proportion of stomach sampled sets were highest in winter and spring surveys with >50% across all years (Table 3.2.1; Figure 3.2.1, 3.2.3). Summer and autumn were both sampled at an overall lower rate (~30%) but were intensively sampled in some years (Table 3.2.1; Figure 3.2.2, 3.2.4).

In total, 71,585 stomachs across 42 species were sampled: species that were consistently sampled across the time period were American plaice, Atlantic cod, haddock, pollock, silver hake and Atlantic halibut (Table 3.2.2).

Thirty species possessed sufficient sample sizes to estimate species accumulation curves (Table 3.2.3). Of these, 18 had a rate of change less than 0.05 suggesting sampling intensity is sufficient to depict diets. Although the SAC for alewife was below 0.05, the small sample size and only six family groups identified suggests that the diet of this species is not fully described. These results are further broken into specific regions and seasons in Table 3.2.3.

The prey resolution across the data source included 257 prey items which represent 123 family groupings in 16 phyla. Of the fish prey identified, 85% were to species level, whereas only 27% of invertebrate prey were listed designated to species.

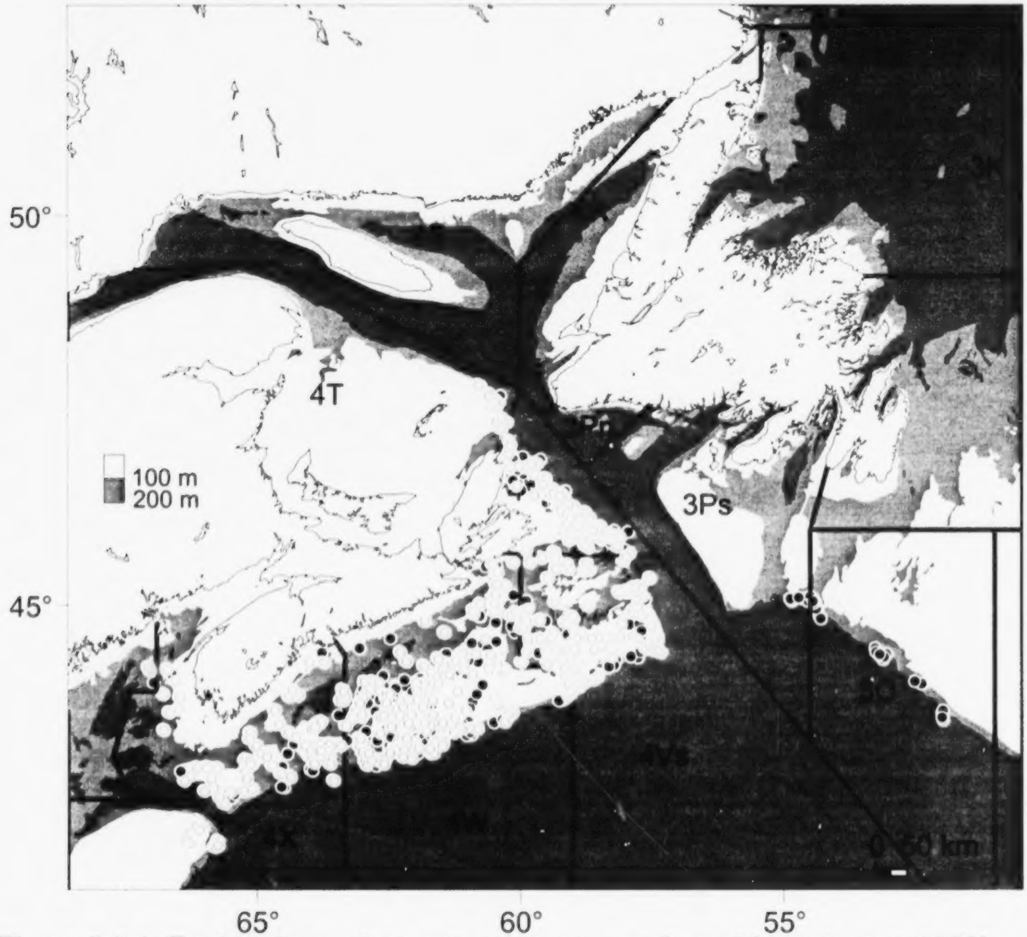
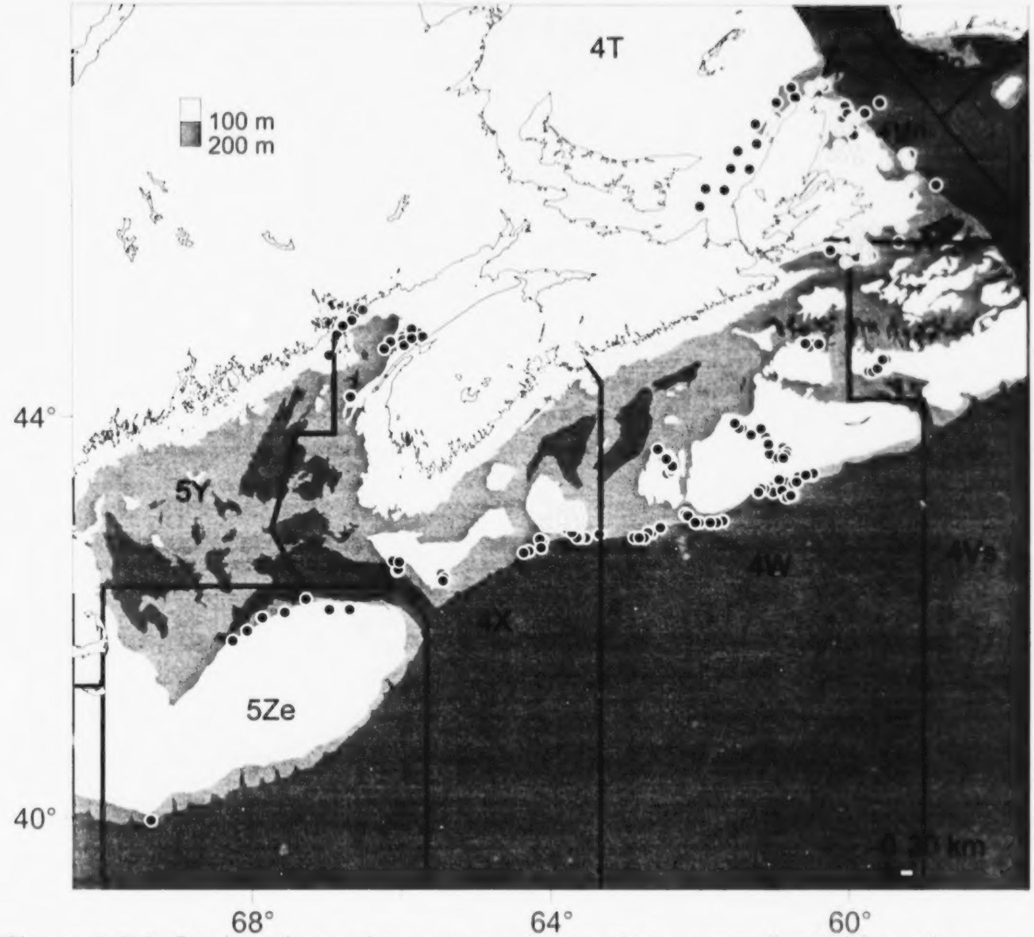


Figure 3.2.1: Set locations where stomachs were collected from the pre-1970's winter surveys. Map depicts 582 sets where stomach samples were collected (white circles) overlaid on the 1121 total sets (black circles).


4T
100 m
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44°
40°
68°
64°
60°
0 20 km

Figure 3.2.2: Set locations where stomach samples were collected from the pre-1970's autumn surveys. The map depicts 109 sets where samples were collected (white circles) overlaid on the 350 total sets (black circles).

identified suggests that the diet of this species is not fully described. These results are further broken into specific regions and seasons in Table 3.2.3.

The prey resolution across the data source included 257 prey items which represent 123 family groupings in 16 phyla. Of the fish prey identified, 85% were to species level, whereas only 27% of invertebrate prey were listed designated to species.

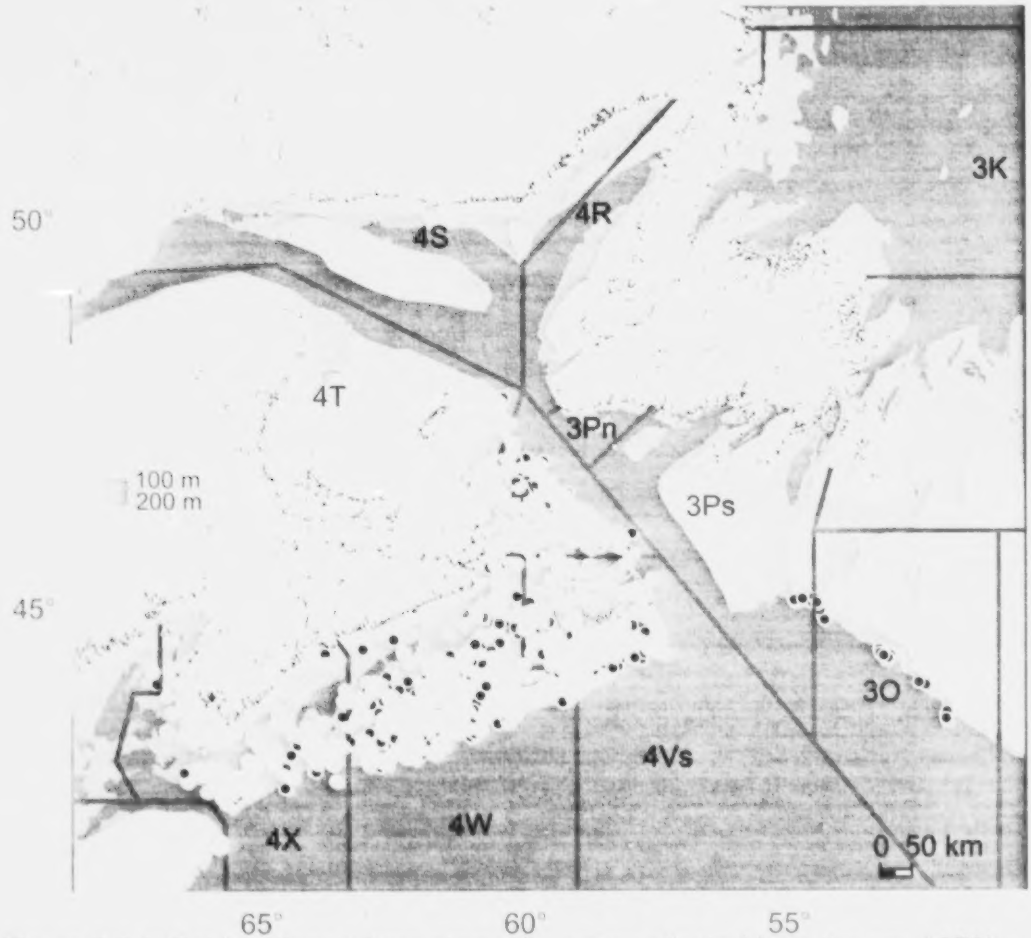

Figure 3.2.1: Set locations where stomachs were collected from the pre-1970's winter surveys. Map depicts 582 sets where stomach samples were collected (white circles) overlaid on the 1121 total sets (black circles).

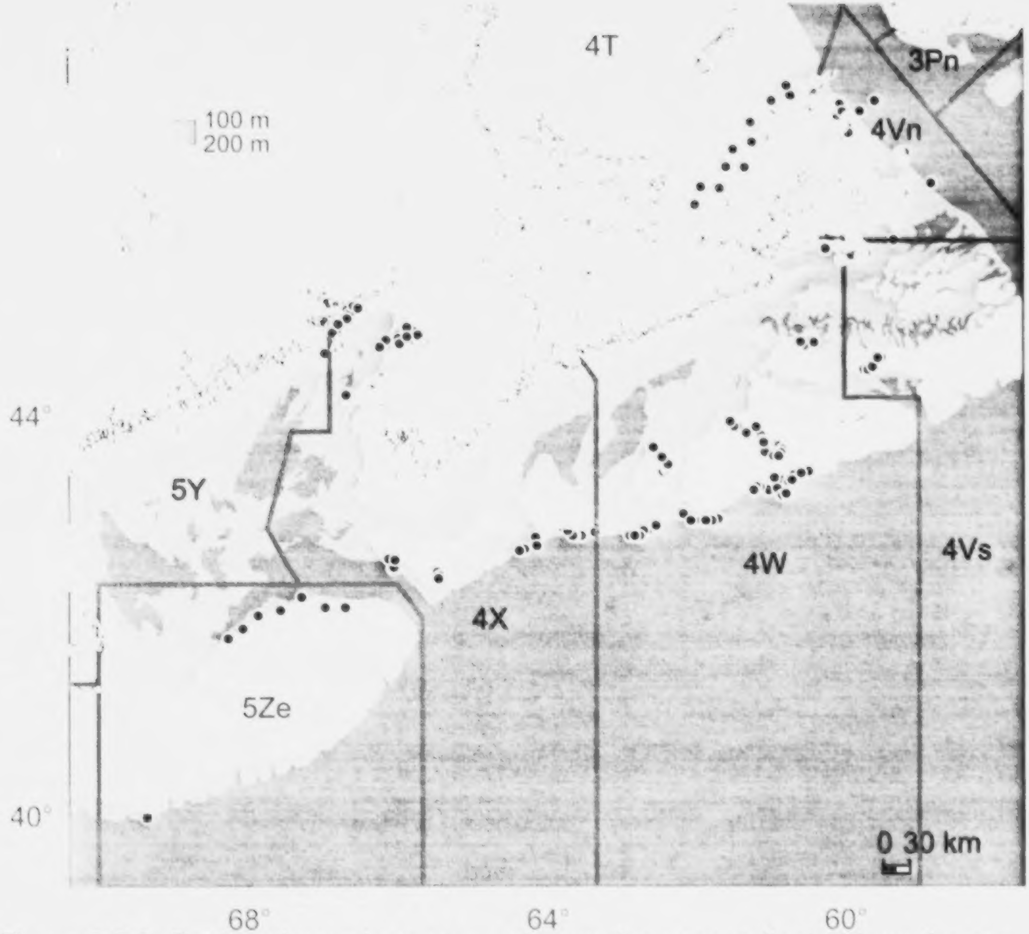
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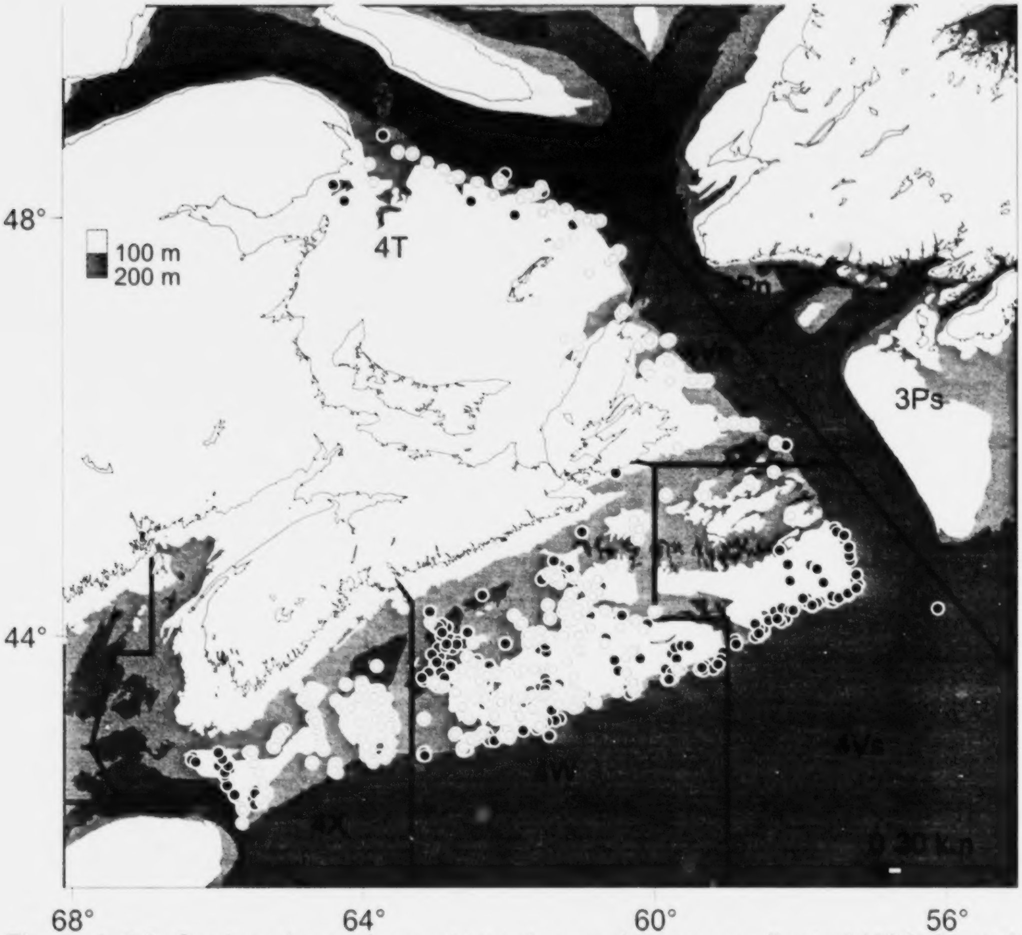
Figure 3.2.2: Set locations where stomach samples were collected from the pre-1970's autumn surveys. The map depicts 109 sets where samples were collected (white circles) overlaid on the 350 total sets (black circles).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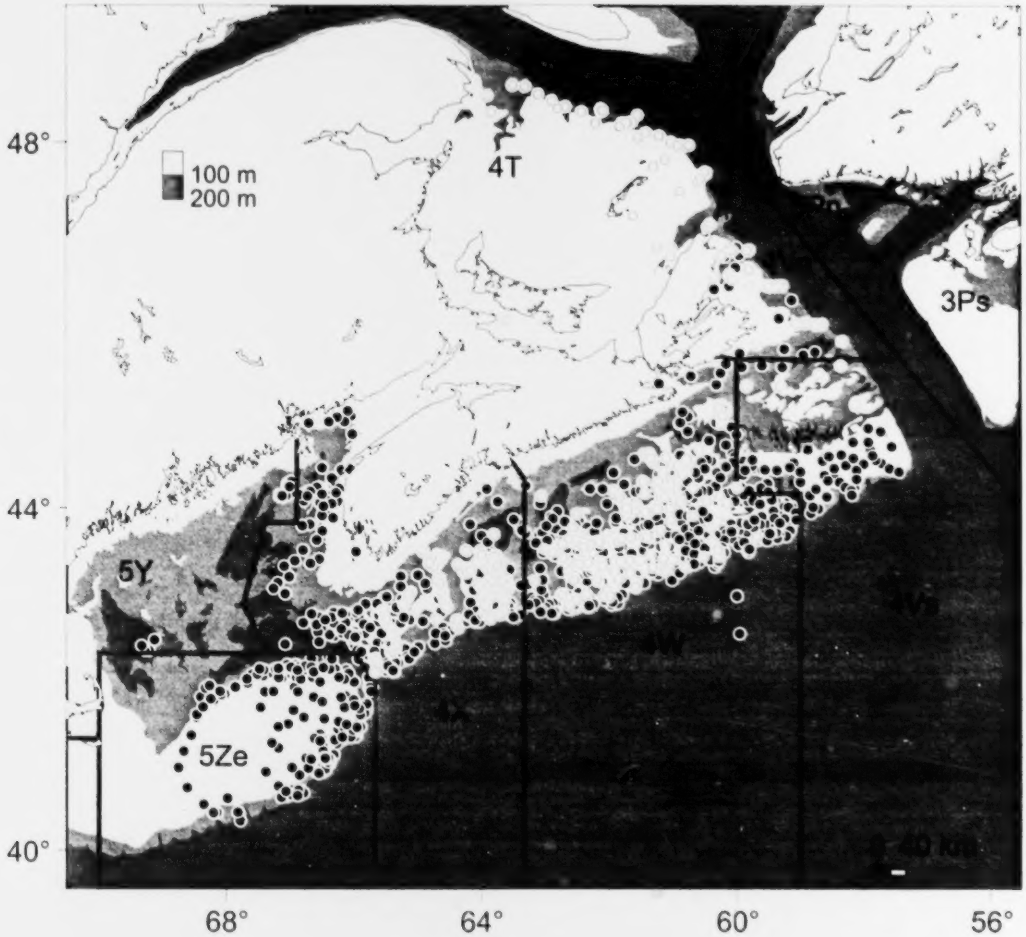
56°

Figure 3.2.3: Set locations where stomach samples were collected (406) from the pre-1970's spring surveys (white circles) overlaid on the 710 total sets (black circles)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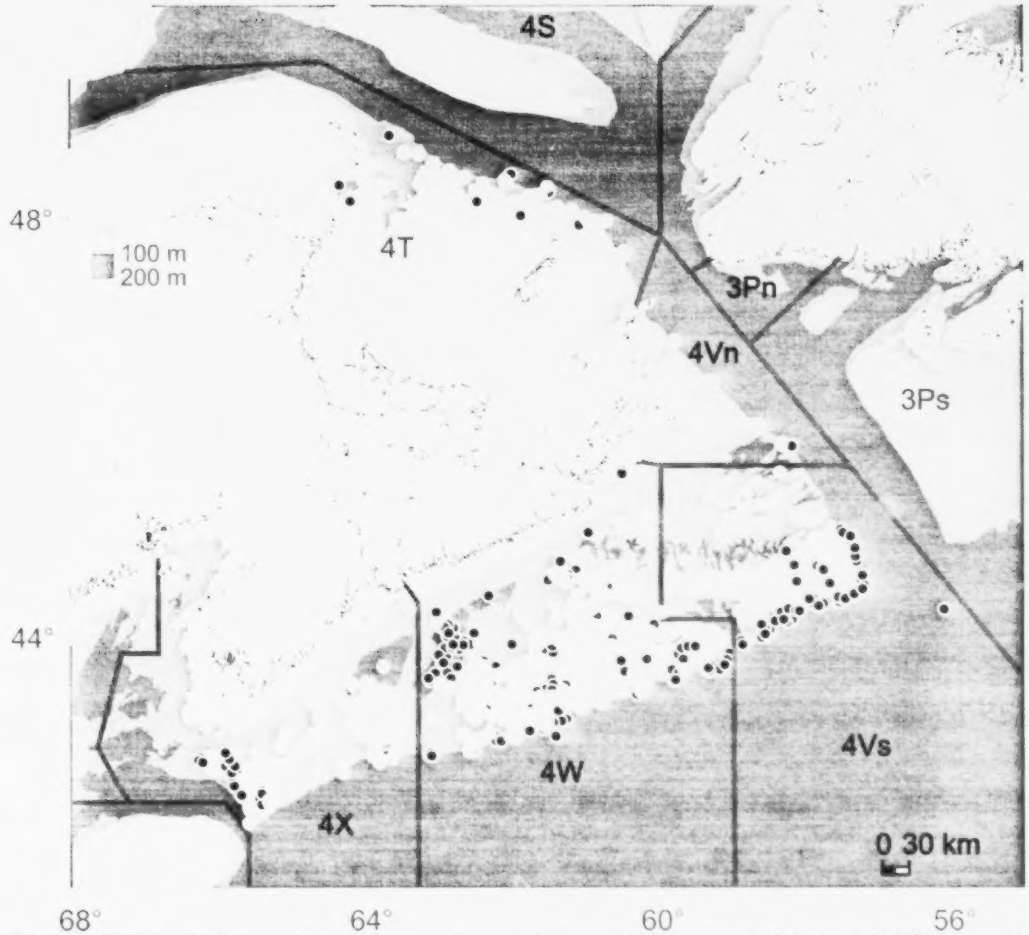
56°

Figure 3.2.4: Set locations where stomach samples were collected from the pre-1970's summer surveys. The map depicts 476 sets where samples were collected (white circles; two sets did not have latitude or longitude information) overlaid on the 1340 total sets (black circles).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3Pn
4Vn
3Ps
44°
4W
4Vs
4X
0 30 km
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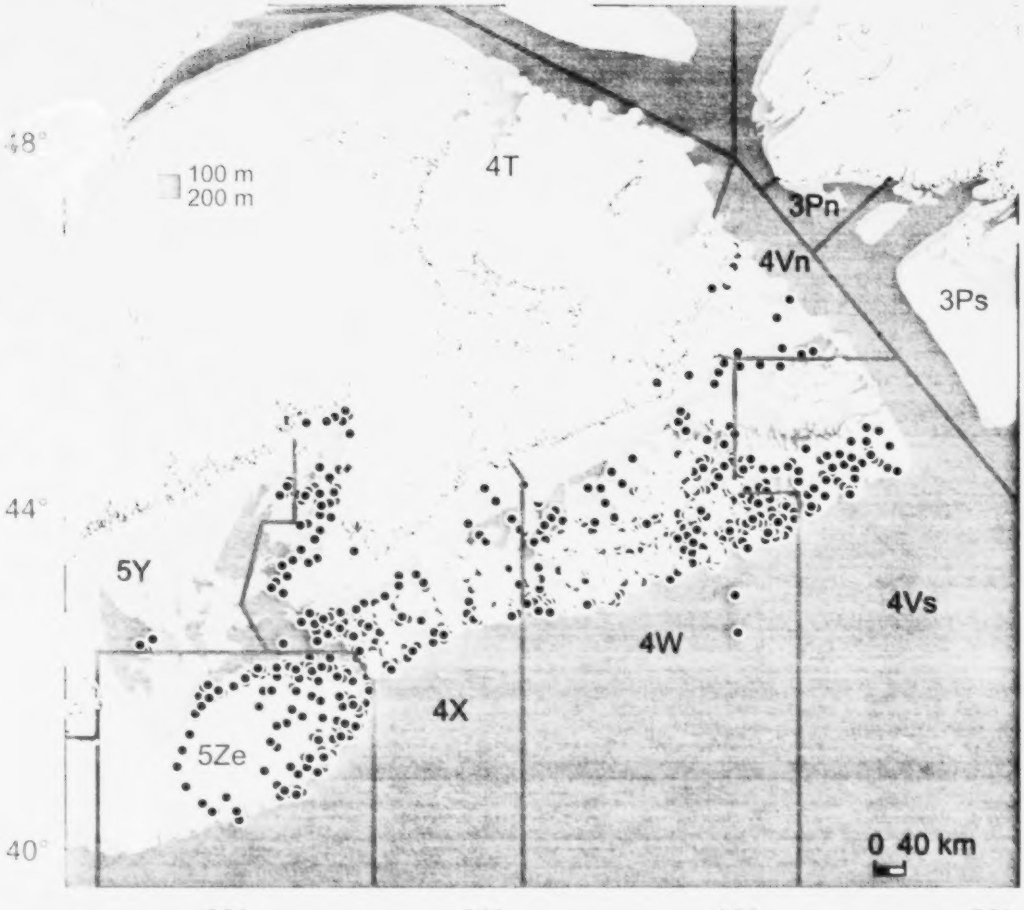
64°
60°
56°

Figure 3.2.3: Set locations where stomach samples were collected (406) from the pre-1970's spring surveys (white circles) overlaid on the 710 total sets (black circles)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4Vn
3Ps
44°
5Y
4Vs
4W
4X
5Ze
40°
0 40 km
68°
64°
60°
56°

Figure 3.2.4: Set locations where stomach samples were collected from the pre-1970's summer surveys. The map depicts 476 sets where samples were collected (white circles; two sets did not have latitude or longitude information) overlaid on the 1340 total sets (black circles).

Table 3.2.1: Frequency of stomach sampling across sets for the pre-1970's data source separated by season.

	Autumn			Summer			Spring			Winter		
Year	Survey Sets	Stomach sampled sets	Percent	Survey Sets	Stomach sampled sets	Percent	Survey Sets	Stomach sampled sets	Percent	Survey Sets	Stomach sampled sets	Percent
1958	.	.	.	78	55	70.5	.	.	.	.	.	.
1959	.	.	.	95	82	86.3	.	.	.	128	86	67.2
1960	26	.	0	55	43	78.2	37	37	100	238	68	28.6
1961	85	12	14.1	13	12	92.3	110	84	76.4	13	11	84.6
1962	81	33	40.7	98	24	24.5	139	112	80.6	89	37	41.6
1963	82	64	78.0	59	23	39.0	5	.	0	149	97	65.1
1964	8	.	0	135	122	90.4	76	62	81.6	130	79	60.8
1965	4	.	0	234	38	16.2	138	102	73.9	105	63	60.0
1966	46	.	0	257	27	10.5	82	.	0	86	81	94.2
1967	18	.	0	137	50	36.5	51	.	0	32	15	46.9
1968	.	.	.	59	.	0	52	9	17.3	19	14	73.7
1969	.	.	.	120	.	0	20	.	0	132	31	23.5
Total	350	109	31.1	1340	476	35.5	710	406	57.2	1121	582	51.9

Table 3.2.2: Counts of stomachs analysed during pre-1970's research surveys.

	Years												
Species	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	Total
Alewife	.	.	.	.	.	.	.	68	209	.	.	.	277
American Plaice	.	391	64	226	256	1290	2035	756	320	285	48	19	5690
Arctic eelpout	.	.	.	.	.	8	.	.	.	.	.	.	8
Argentine	33	.	.	.	.	35	283	545	78	42	10	.	1026
Atlantic cod	171	1497	2593	1344	3361	2409	3499	3233	1485	342	197	1399	21530
Atlantic halibut	.	.	32	113	169	81	51	42	24	4	10	.	526
Atlantic wolffish	.	.	3	.	.	73	.	.	.	.	.	.	76
Barndoor skate	.	.	.	.	2	32	42	94	42	3	.	.	215
Black dogfish	.	.	.	.	.	.	19	.	.	.	.	.	19
Butterfish	.	.	.	.	.	.	2	.	.	.	.	.	2
Cusk	.	.	.	.	.	85	180	199	161	1	.	.	626
Eelpout (ns)	.	.	.	.	.	3	27	4	1	.	.	.	35
Four beard rockling	.	.	.	.	.	.	10	.	.	.	.	.	10
Greenland halibut	.	.	.	.	.	.	2	2	.	.	.	.	4
Grenadier	.	.	.	.	.	.	11	62	1	.	.	.	74
Haddock	1180	3503	2107	2065	2929	2392	4476	4857	1996	573	370	.	26448
Herring	.	.	.	.	.	.	93	394	75	.	.	.	562
Little skate	.	.	.	.	.	1	26	.	.	1	.	.	28
Longfin hake	.	.	.	.	.	6	58	86	2	.	.	.	152
Longhorn sculpin	.	.	.	.	.	37	119	16	17	.	.	.	189
Longnose eel	.	.	.	.	.	.	.	11	.	.	.	.	11
Lumpfish	.	.	.	.	.	17	.	5	.	.	.	.	22
Mailed sculpin	.	.	.	.	.	.	1	.	.	.	.	.	1
Monkfish	.	.	.	.	.	79	50	109	24	.	.	.	262
Northern wolffish	.	.	.	.	.	82	60	48	25	4	1	.	220
Pollock	9	64	12	274	292	558	372	623	266	17	.	.	2487
Red hake	.	.	.	.	.	.	17		9	.	.	.	26
Redfish	.	.	.	.	.	.	563	186	22	.	.	.	771
Sea raven	.	.	.	.		20	25	5	1	.	.	.	51
Silver hake	11	38	.	.	116	179	447	198	77	.	113	.	1179
Smelt	.	.	.	.			6		.	.	.	.	6
Smooth skate	.	.	.	.		21	48	19	6	1	.	.	95
Spiny dogfish	.	.	.	.		76	41	13	17		.	.	147
Spiny lumpfish	.	.	.	.		2		1	7		.	.	10
Spotted wolffish	.	.	.	.	17		3	3	.		.	.	23
Thorny skate	.	.	.	.	153	337	229	129	110	41	.	.	999
White hake	.	.	.	.	178	418	442	171	21	6	.	.	1236
Windowpane flounder	.	2	.	.	.	.	2	.	.	.	.	.	4
Winter flounder	.	4	.	2	.	.	230	2	4	2	.	.	244
Winter skate	.	.	.	.	120	125	55	4	76	.	.	.	380
Witch flounder	6	2	.	.	48	640	1122	826	55	22	.	.	2721
Yellowtail flounder	.	22	.	4	70	119	685	11	1238	985	59	.	3193
Total	1410	5523	4811	4028	7711	9125	15331	12722	6369	2329	808	1418	71585

Table 3.2.3: Results of species accumulation curves for species collected during spring and summer pre-1970's. For each region, season and species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

Region	4TVWX5Z			4VW						4X					
Season	All			Summer			Spring			Summer			Spring		
Species	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey
Alewife	31	0.03	6	.	.	.	.	.	.	.	.	.	21	0.05	5
American plaice	2648	0.01	70	761	0.02	44	554	0.02	41	78	0.06	18	288	0.03	26
Argentine	335	0.01	13	103	0.02	9	33	0.03	4	20	0.01	3	.	.	.
Atlantic cod	17289	0.01	88	1954	0.01	46	6322	0.01	70	928	0.01	41	1474	0.01	60
Atlantic halibut	430	0.01	29	26	0.19	12	63	0.05	15	39	0.13	13	25	0.2	9
Atlantic herring	217	0.01	8	.	.	.	.	.	.	.	.	.	42	0.02	4
Atlantic wolfish	62	0.13	17	.	.	.	59	0.14	16	.	.	.	.	.	.
Barndoor skate	133	0.08	28	16	0.56	13	30	0.27	10	.	.	.	32	0.25	14
Cusk	91	0.13	27	20	0.2	8	.	.	.	20	0.35	14	27	0.26	11
Eelpout Unid.	23	0.13	10	15	0.01	6	.	.	.	.	.	.	.	.	.
Grenadier	17	0.12	6	.	.	.	.	.	.	.	.	.	.	.	.
Haddock	21552	0.01	99	5000	0.01	61	3574	0.01	72	1716	0.01	46	2397	0.01	66
Longfin hake	37	0.01	3	.	.	.	.	.	.	.	.	.	.	.	.
Longhorn sculpin	78	0.05	18	32	0.09	10	.	.	.	.	.	.	.	.	.
Lumpfish	21	0.28	10	.	.	.	16	0.25	8	.	.	.	.	.	.
Monkfish	92	0.15	24	.	.	.	31	0.13	10	.	.	.	15	0.73	15
Pollock	1966	0.01	41	169	0.04	20	274	0.01	17	313	0.01	15	330	0.02	20
Redfish	234	0.01	6	33	0.05	3	.	.	.	130	0.01	3	.	.	.
Sea raven	26	0.19	9	.	.	.	.	.	.	.	.	.	.	.	.
Silver hake	417	0.02	19	55	0.13	10	34	0.09	5	15	0.06	2	.	.	.
Smooth skate	66	0.08	17	21	0.33	10	25	0.24	11	.	.	.	.	.	.
Spiny dogfish	67	0.09	10	.	.	.	.	.	.	.	.	.	.	.	.
Spotted wolffish	22	0.23	12	.	.	.	.	.	.	.	.	.	.	.	.
Thorny skate	798	0.01	45	117	0.07	21	281	0.04	33	25	0.24	12	72	0.08	19
White hake	641	0.02	37	79	0.1	17	136	0.02	12	43	0.19	13	65	0.05	10
Winter flounder	167	0.05	18	22	0.28	11	.	.	.	.	.	.	.	.	.
Winter skate	243	0.04	19	.	.	.	87	0.06	9	.	.	.	20	0.2	10
Witch flounder	1483	0.01	28	300	0.02	18	599	0.01	18	.	.	.	85	0.04	7
Wolffish unid.	123	0.13	38	.	.	.	.	.	.	.	.	.	56	0.26	25
Yellowtail floun.	1949	0.01	41	1599	0.01	35	264	0.03	24	.	.	.	.	.	.

3.3 Pelagic surveys (PS)- 1999-2000

Pelagic surveys were conducted in October and November of 1999 and 2000. The goals of these surveys were to determine the abundance and distribution of herring using a combination of ichtyoplankton, hydro acoustic and bottom trawl gears. Stomachs were collected from samples obtained through bottom trawls in 4VsW and 5Ze (Figure 3.3.1). Stomachs were excised, and if found to contain prey items were frozen in brine for later analysis by FSRS technicians.

References

Melvin, G. and M. Power. 1999. Herring Acoustic Survey Report: CGS Alfred Needler – N99-55, N99-60. Department of Fisheries and Oceans, Biological Sciences Branch, Maritimes Region, 6 pp.

3.3.1 Summary of PS Data

A total of 980 stomachs were collected across 26 species (Table 3.3.1), however, species accumulation curves suggest that only haddock and herring have been sampled intensively enough for diet description (Table 3.3.2). Seventy- eight prey items were identified representing 56 family groups and nine phyla. Of the prey items identified 79% of fish were to species level whereas only 8% of invertebrates were detailed to species.

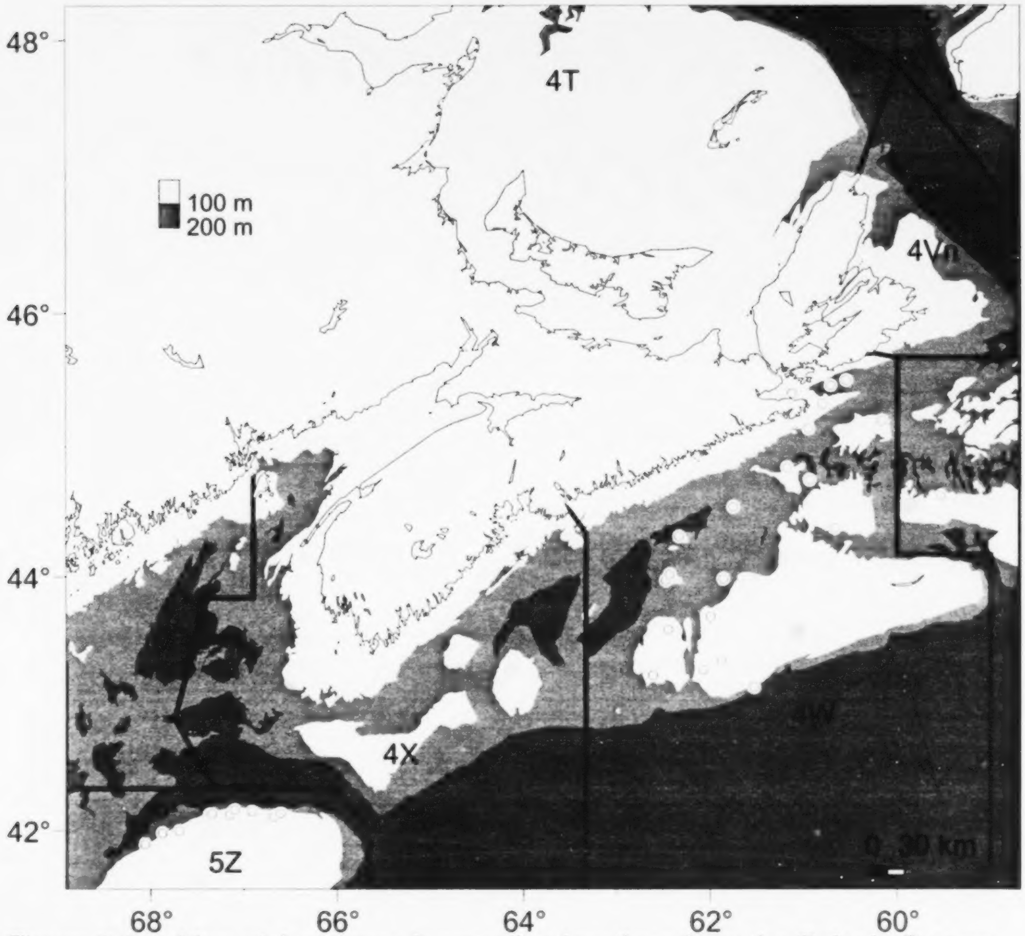
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Figure 3.3.1: Map of the stomach sampling locations from the Pelagic Survey. This map depicts all 31 sets where stomachs were collected.

Table 3.3.1: Count of the stomach samples taken during the Pelagic Survey (PS).

	Year		
Species	1999	2000	Total
American Plaice	54	11	65
Atlantic cod	94	4	98
Atlantic halibut	1	1	2
Atlantic wolffish	1	.	1
Greenland halibut	4	22	26
Haddock	139	97	236
Herring	105	28	133
Longhorn sculpin	70	.	70
Mackerel	55	1	56
Monkfish	4	.	4
Ocean pout	.	2	2
Pollock	6	34	40
Red hake	20	3	23
Redfish	5	7	12
Sandlance	.	10	10
Sea raven	8	.	8
Silver hake	54	15	69
Smooth skate	4	.	4
Spiny dogfish	1	.	1
Thorny skate	1	.	1
Vahl's eelpout	1	.	1
White hake	26	1	27
Winter flounder	12	.	12
Winter skate	18	.	18
Witch Flounder	5	.	5
Yellowtail flounder	48	8	56
Total	736	244	980

Table 3.3.2: Results of species accumulation curves for species collected during Pelagic Surveys. For each region and species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

Region	All			4VW		
Species	n	min	nprey	n	min	nprey
American plaice	65	0.06	16	62	0.06	16
Atlantic cod	98	0.08	33	61	0.08	20
Greenland halibut	26	0.11	8	26	0.11	8
Haddock	236	**0.04**	42	199	**0.04**	35
Herring	133	**0.01**	7	40	**0.01**	4
Longhorn sculpin	70	0.11	21	20	0.34	10
Mackerel	56	0.14	13	.	.	.
Pollock	40	0.12	12	35	0.08	7
Red hake	22	0.08	10	.	.	.
Silver hake	69	0.07	14	37	0.16	12
White hake	27	0.11	7	27	0.11	7
Winter skate	18	0.44	21	.	.	.
Yellowtail flounder	56	0.16	20	30	0.2	14

3.4 Condition Factor (CF)- 1999-2002

Stomach samples were collected dockside from commercial fishing vessels as part of a condition factor study. Samples were collected throughout 1999-2002 from trips mainly focussed on 4VWX5Z (Figure 3.4.1). Samples were processed in the lab by FSRS technicians.

3.4.1 Summary of CF data

A total of 3034 stomachs representing 19 species were collected (Table 3.4.1). Of these species, nine had SAC with minimum slopes <0.05 (Table 3.4.2), however silver hake were only represented by a few fish with four prey family groups being depicted suggesting their diet is not fully described. The SAC's were further broken down by region.

There were 99 prey items represented in this data source representing 65 family groups and 12 phyla. Of the fish species identified 74% were to species level whereas 21% of invertebrates were to species.

Table 3.4.1: Count of the stomach samples collected by year for the Condition Factor surveys.

	Year					
Species	1998	1999	2000	2001	2002	Total
American plaice	.	277	248	.	.	525
Atlantic cod	15	346	118	24	22	525
Atlantic wolffish	.	.	121	.	.	121
Cusk	.	18	5	.	.	23
Greenland halibut	.	38	68	.	.	106
Haddock	6	392	96	106	.	600
Herring	.	4	.	1	.	5
Mackerel	.	.	4	.	.	4
Monkfish	.	.	.	.	.	6
Pollock	.	87	.	42	.	129
Redfish	7	59	108	.	.	174
Silver Hake	.	26	.	.	.	26
Spiny dogfish	.	7	1	.	.	8
Thorny skate	.	18	60	.	.	78
White hake	.	21	20	.	.	41
Winter flounder	.	19	1	.	.	20
Winter skate	.	28	69	.	.	97
Witch flounder	.	302	214	.	.	516
Yellowtail flounder	.	8	22	.	.	30
Total	28	1650	1155	173	22	3034

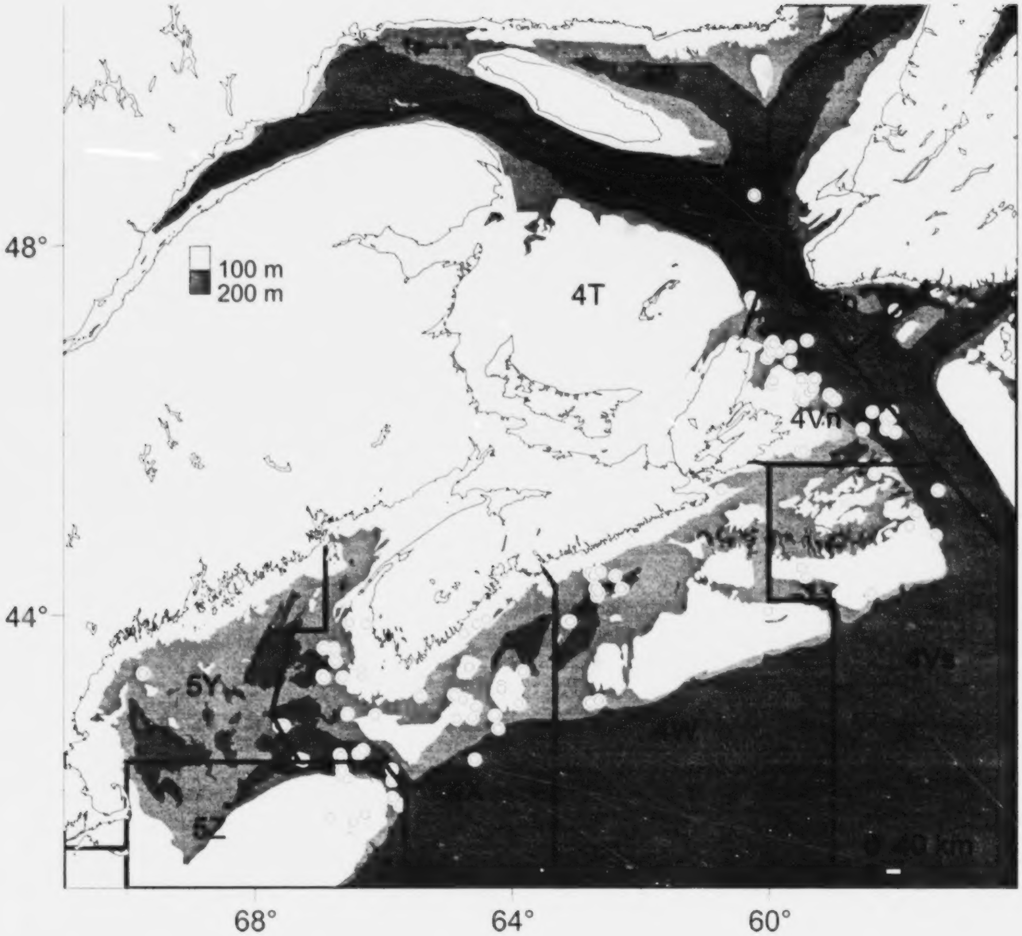

100 m
200 m
48°
44°
68°
64°
60°
4T
4Vn
4Vs
4W
4X
5Y
5Z
0 40 km

Figure 3.4.1: Map of the stomach sampling locations from the Condition factor surveys. This map depicts 177 of 218 sets.

Table 3.4.2: Results of species accumulation curves for species collected during Condition Factor Surveys. For each region and species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

	All			4VW			4X		
Species	n	min	nprey	n	min	nprey	n	min	nprey
American plaice	460	0.02	24	343	0.02	21	.	.	.
Atlantic cod	524	0.02	44	165	0.05	34	270	0.03	36
Atlantic wolffish	108	0.07	18	97	0.09	18	.	.	.
Greenland halibut	56	0.07	12	56	0.07	12	.	.	.
Haddock	582	0.02	44	.	.	.	413	0.02	36
Pollock	129	0.02	14	.	.	.	68	0.04	12
Redfish	149	0.03	9	108	0.03	8	.	.	.
Silver hake	26	0.04	4	.	.	.	.	.	.
Thorny skate	65	0.03	10	65	0.03	10	.	.	.
White hake	24	0.12	8	24	0.12	8	.	.	.
Winter flounder	20	0.4	17	.	.	.	.	.	.
Winter skate	92	0.01	4	92	0.01	4	.	.	.
Witch flounder	413	0.02	18	410	0.02	18	.	.	.
Yellowtail flounder	25	0.24	12	.	.	.	.	.	.

3.5 Silver hake surveys (SHS)- 1981-1986

Silver hake predation and cannibalism were examined through the collection of stomachs from groundfishes captured from a combination of research surveys and commercial fishing trips (Waldron 1988). This work focussed on NAFO Divisions 4VWX5Z but also included some trips to NAFO Divisions 3LMNOP and 4R (Figure 3.5.1). Data was collected throughout 1981-1986.

References

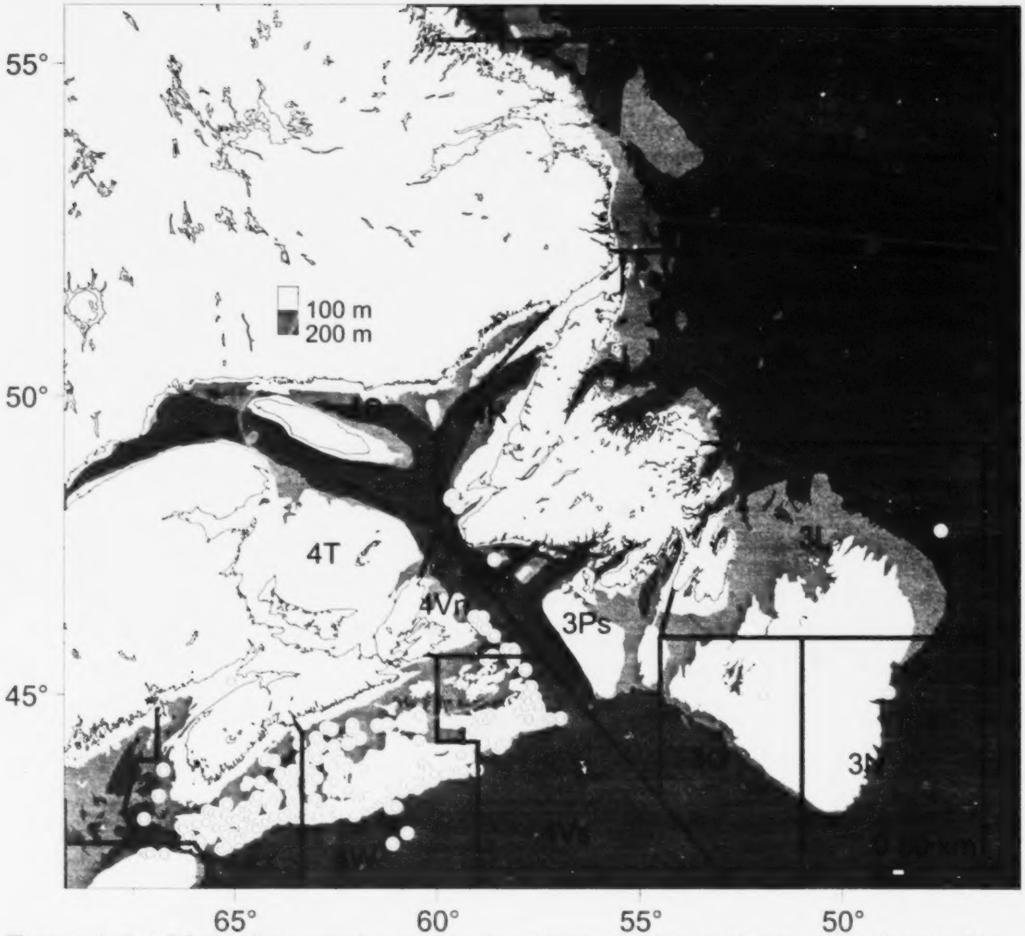
Waldron, D. E. 1988. Trophic biology of the silver hake (*Merluccius bilinearis*) population on the Scotian Shelf. Ph. D. Thesis, Dalhousie University, Halifax, NS. 363 pp.

3.5.1 Summary of SHS data

A total of 4535 stomachs were collected from 16 species although the majority of samples were from Atlantic cod, silver hake, haddock and pollock (Table 3.5.1). The results from species accumulation curves show that Atlantic cod and silver hake were sampled intensively enough for diet description (Table 3.5.2), although not for all seasons. Stomach contents consisted of 375 prey items, from 170 family groups across 16 phyla. Of the fish species identified 62% were to species level whereas 39% of invertebrate prey were to species.

Table 3.5.1: Stomach sample counts by species and year collected during the Silver Hake Surveys.

	Year						
Species	1981	1982	1983	1984	1985	1986	Total
Atlantic cod	78	40	230	488	391	.	1227
Haddock	84	.	76	77	25	.	262
White hake	.	.	6	21	.	.	27
Red hake	.	.	22	28	.	.	50
Silver hake	1171	446	768	165	3	121	2674
Pollock	21	.	31	55	30	.	137
Redfish	.	.	17	13	.	.	30
Atlantic halibut	.	.	.	3	.	.	3
American plaice	.	.	32	3	.	.	35
Witch flounder	.	.	5	.	.	.	5
Yellowtail flounder	.	.	31	6	.	.	37
Winter flounder	.	.	.	.	10	.	10
Argentine	5	.	.	8	.	.	13
Thorny skate	.	.	.	1	.	.	1
Longhorn sculpin	.	.	.	1	.	.	1
Monkfish	.	.	7	16	.	.	23
Total	1359	486	1225	885	459	121	4535


55°
50°
45°
100 m
200 m
4T
4Vn
3Ps
4Vs
65°
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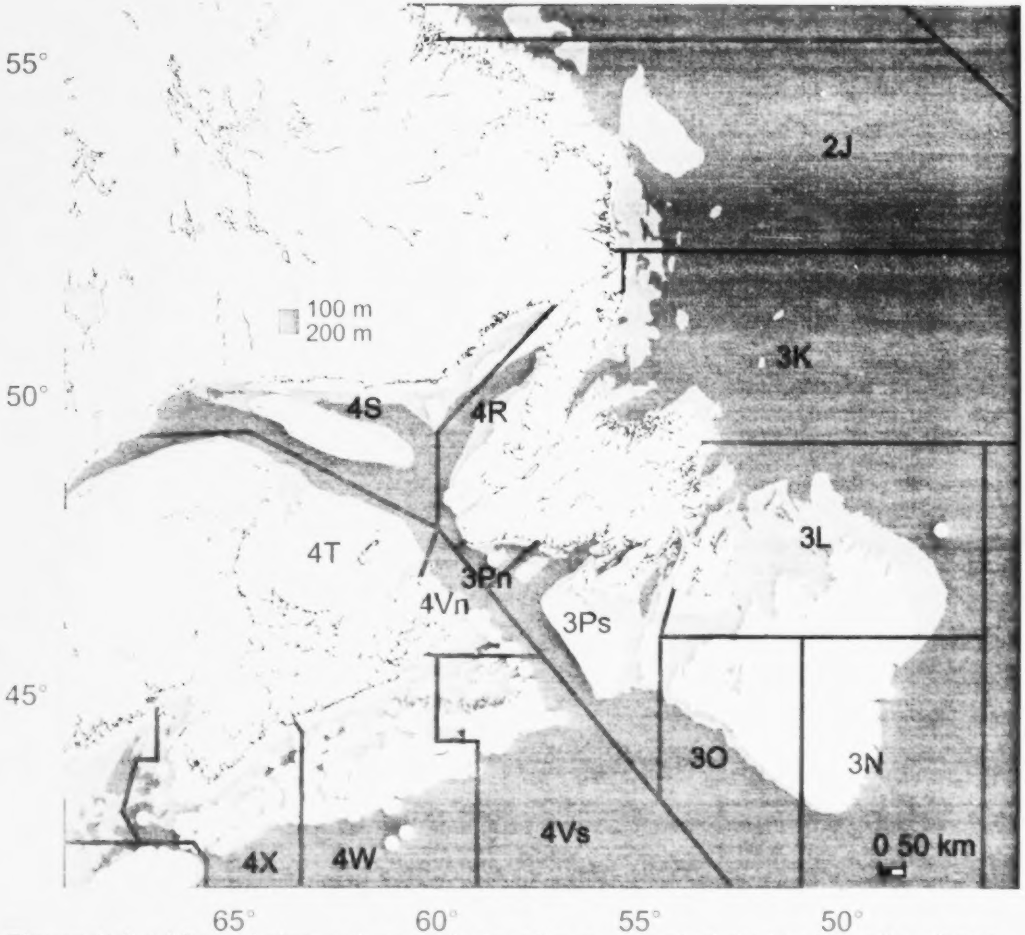
55°
50°

Figure 3.5.1 Map of stomach sample locations collected during the silver hake surveys. This map represents 375 set locations.


55°
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2J
3K
4S
4R
3L
4T
3Pn
4Vn
3Ps
3O
3N
4X
4W
4Vs
0 50 km

Figure 3.5.1 Map of stomach sample locations collected during the silver hake surveys. This map represents 375 set locations.

Table 3.5.2: Results of species accumulation curves for species collected during Silver hake surveys. For each region, season and species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

	All			4VW												4X											
	All			Autumn			Spring			Summer			Winter			Autumn			Spring			Summer			Winter		
Species	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey
American plaice	35	0.22	16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Atlantic cod	1216	**0.02**	98	149	0.12	40	578	**0.04**	63	199	0.09	48	87	0.15	30	32	0.34	21	.	.	.	66	0.14	29	15	0.52	18
Haddock	259	0.13	135	.	.	.	41	0.61	48	32	0.43	36	.	.	.	84	0.32	111	20	0.64	26	82	0.21	58	.	.	.
Monkfish	21	0.14	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pollock	134	0.06	17	.	.	.	15	0.26	8	16	0.31	8	.	.	.	65	**0.02**	8	19	0.16	8	19	0.21	9	.	.	.
Red hake	49	0.31	31	.	.	.	23	0.22	13	.	.	.	.	.	.	15	0.66	20	.	.	.	.	.	.	.	.	.
Silver hake	2420	**0.01**	54	133	**0.02**	11	1080	**0.01**	30	798	**0.01**	28	121	**0.02**	12	65	0.18	18	82	**0.04**	11	134	0.07	22	.	.	.
White hake	27	0.26	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Yellowtail flounder	35	0.45	37	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

3.6 Fisheries Ecology Program (FEP) - 1982-1983

The Fisheries Ecology Program was a multidiscipline study designed to study the ecology of the commercially important gadoid fisheries on the southwestern Scotian Shelf (Smith et al. 1989). One particular aspect of the project was to examine the spatial and temporal variation in haddock diet. Stomach samples were collected mainly in NAFO Division 4X during a series of cruises in 1982 and 1983 including the Standard Spring, Summer and Autumn Groundfish Surveys during that time, Silver Hake Surveys, and directed FEP surveys (Figure 3.6.1). All surveys used a Western IIA bottom trawl.

References

Mahon, R. and M. Buzeta 1983. Cruise Report: Lady Hammond – H088, H089. 1983. Department of Fisheries and Oceans, Atlantic Fisheries Service, Marine Fish Division, Fisheries Research Branch, Scotia-Fundy Region, 4 pp.

Smith, P.C., K.T. Frank, and R. Mahon. 1989. General introduction to southwest Nova Scotia Fisheries Ecology Program (FEP): 1982-89. Canadian Journal of Fisheries and Aquatic Sciences. 46: 2-3.

Waiwood, K. 1983. Cruise Report: Alfred Needler – N010. Department of Fisheries and Oceans, Atlantic Fisheries Service, Marine Fish Division, Fisheries Research Branch, Scotia-Fundy Region, 4 pp.

3.6.1 Summary of FEP data

A total of 4397 haddock stomachs were collected across all seasons in 1982-1983 (Table 3.6.1). Results from species accumulation curves suggest that haddock diet can be well described in all seasons (Table 3.6.2). The prey items are represented by 302 prey items across 156 family groups and 18 phyla. Of the prey identified 65% of fish were identified to species level whereas 33% of invertebrates were to species.

Table 3.6.1: Count of stomach samples collected during the Fisheries Ecology Program.

Species	1982	1983	Total
Haddock	2432	1965	4397

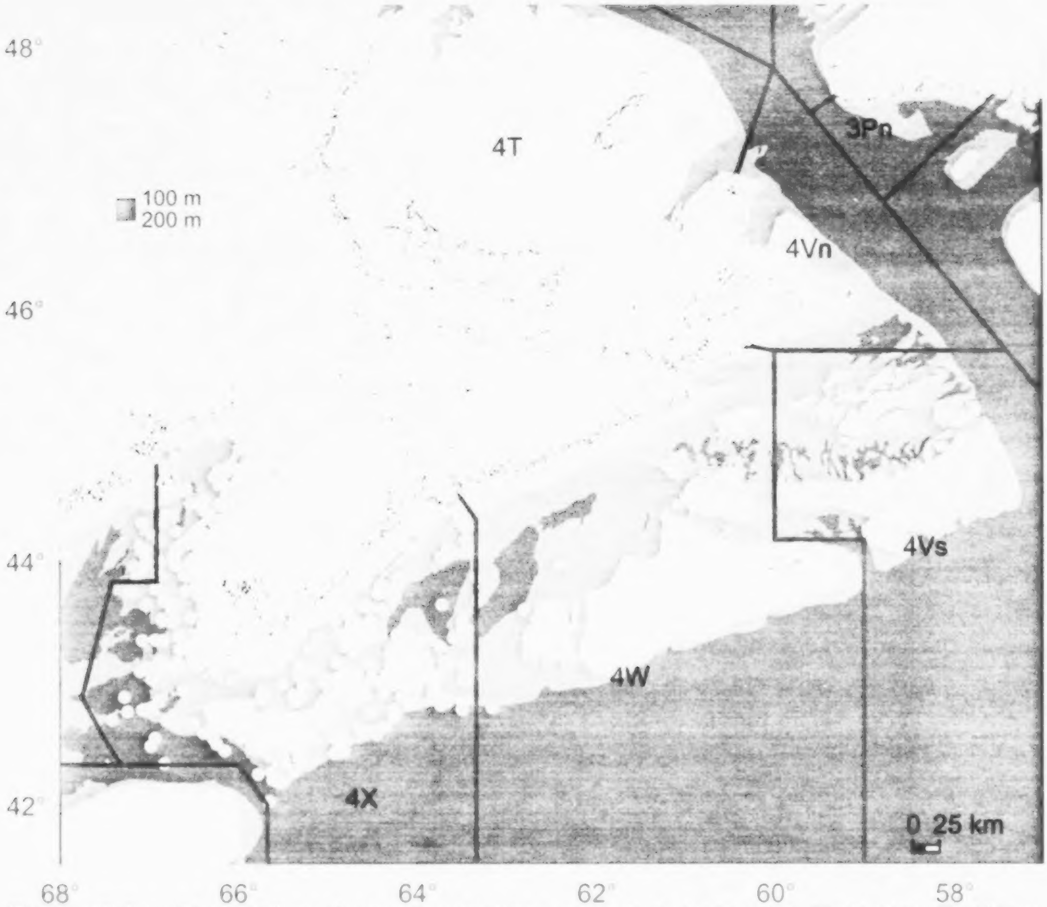

Figure 3.6.1: Map of the stomach samples collected during the Fisheries Ecology Program Surveys. This map depicts 337 set locations.

Table 3.6.2: Results of species accumulation curves for haddock collected during Fisheries Ecology Program Surveys. For each season, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

Region	All			4X											
Season	All			Autumn			Spring			Summer			Winter		
Species	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey
Haddock	4373	0.01	156	847	0.02	107	1032	0.02	118	925	0.02	122	1472	0.01	129

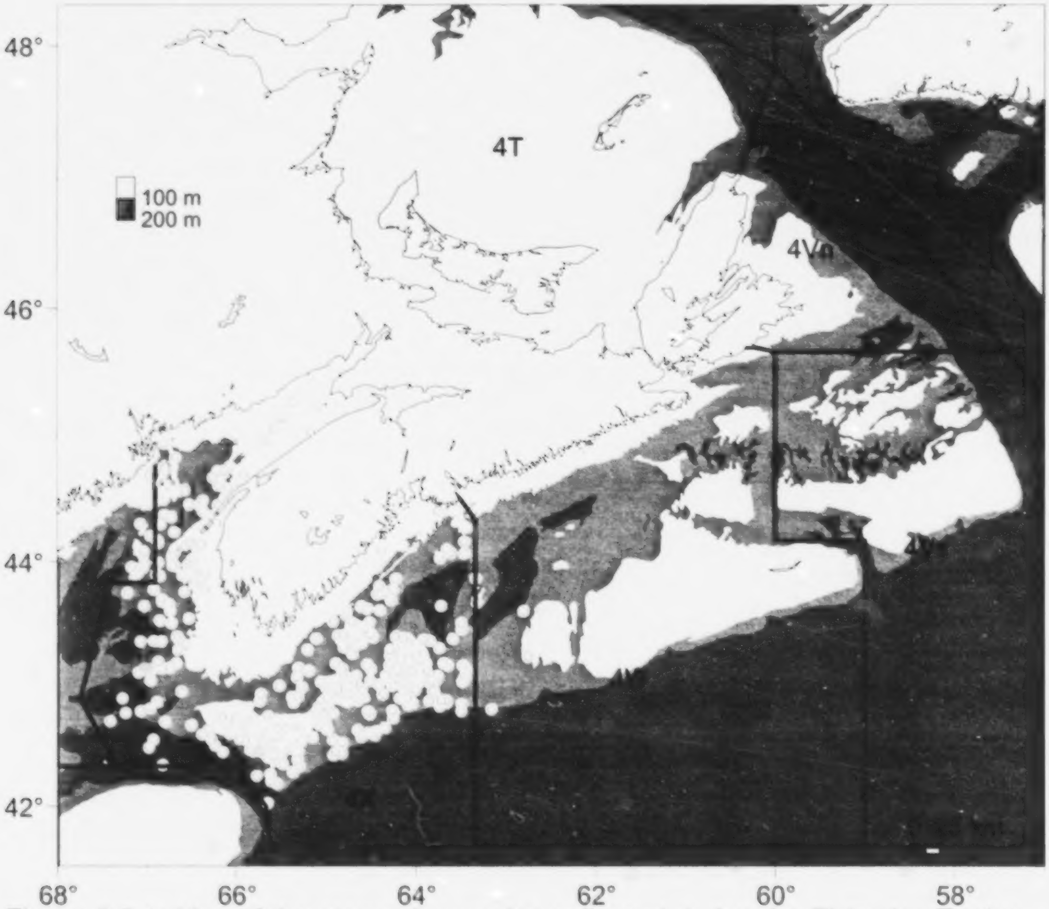

Figure 3.6.1: Map of the stomach samples collected during the Fisheries Ecology Program Surveys. This map depicts 337 set locations.

Table 3.6.2: Results of species accumulation curves for haddock collected during Fisheries Ecology Program Surveys. For each season, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

Region	All			4X											
Season	All			Autumn			Spring			Summer			Winter		
Species	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey	n	min	nprey
Haddock	4373	0.01	156	847	0.02	107	1032	0.02	118	925	0.02	122	1472	0.01	129

3.7 4VsW Sentinel Surveys- Stratified Survey (SS, JSS), Commercial Index Observer Coverage (CI) and Commercial Index Sampling from Fishermen (CS)- 1996-2002

The sentinel survey was a long-line survey conducted during autumn in 4VsW (Figure 3.7.1). This survey consisted of two main components, a stratified survey where stomachs were collected by crew (SS) or observers (JSS) and a commercial index where stomachs were collected by observers at sea (CI) or from fishermen on shore (CS). Stomachs from the stratified portion were examined for contents and non-empty stomachs were frozen in brine for analysis in the lab by FSRS technicians.

3.7.1 Summary of data from SS, JSS, CI and CS

A total of 3302 stomachs representing 12 species exist in this data source (Table 3.7.1). Atlantic cod, haddock and white hake were consistently represented in the samples across years and were the only species that were sufficiently sampled for diet description (Table 3.7.2).

Stomach contents across all species were represented by 110 prey items from 66 family groups in 10 phyla. Of the prey items identified 85% of fish were to species level, whereas 20% of invertebrates were species.

Table 3.7.1: Count of stomach samples from SS, JSS, CI and CS

Species	1996	1997	1998	1999	2000	2001	2002	Unknown	Total
American plaice	.	.	.	7	.	.	.	.	7
Atlantic cod	383	289	204	949	280	190	209	.	2504
Atlantic halibut	1	.	.	3	.	.	.	.	4
Cusk	.	.	.	25	.	.	.	.	25
Haddock	153	153	59	48	59	60	49	.	581
Monkfish	.	.	.		.	.	2	.	2
Pollock	2	.	1	7	2	.	16	.	28
Red hake	.	.	.	4	.	.	.	.	4
Silver hake	.	.	.		.	.	.	3	3
Spiny dogfish	.	.	.	22	.	.	.	5	27
Thorny skate	.	.	.	10	.	.	.	.	10
White hake	7	17	5	30	18	9	19	2	107
Total	546	459	269	1105	359	259	295	10	3302

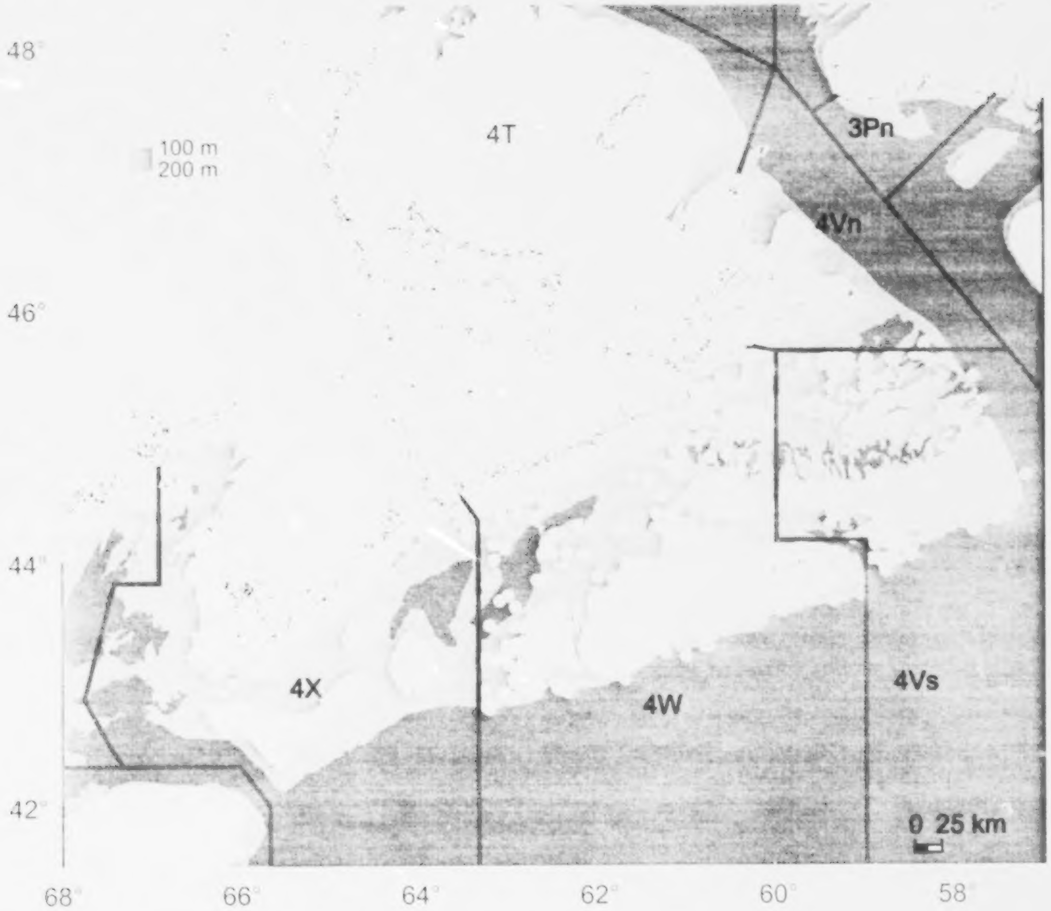

Figure 3.7.1: Map of sampling locations from SS, JSS, CI and CS. This map represents 531 of 640 set locations, which had positional information.

Table 3.7.2: Results of species accumulation curves for species collected during the CI and CS portion of the 4VsW Sentinel Surveys. For each species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

	All		
Species	n	min	nprey
Atlantic cod	2413	0.01	60
Cusk	23	0.22	10
Haddock	538	0.02	51
Pollock	28	0.18	11
Spiny dogfish	21	0.24	8
White hake	104	0.05	16

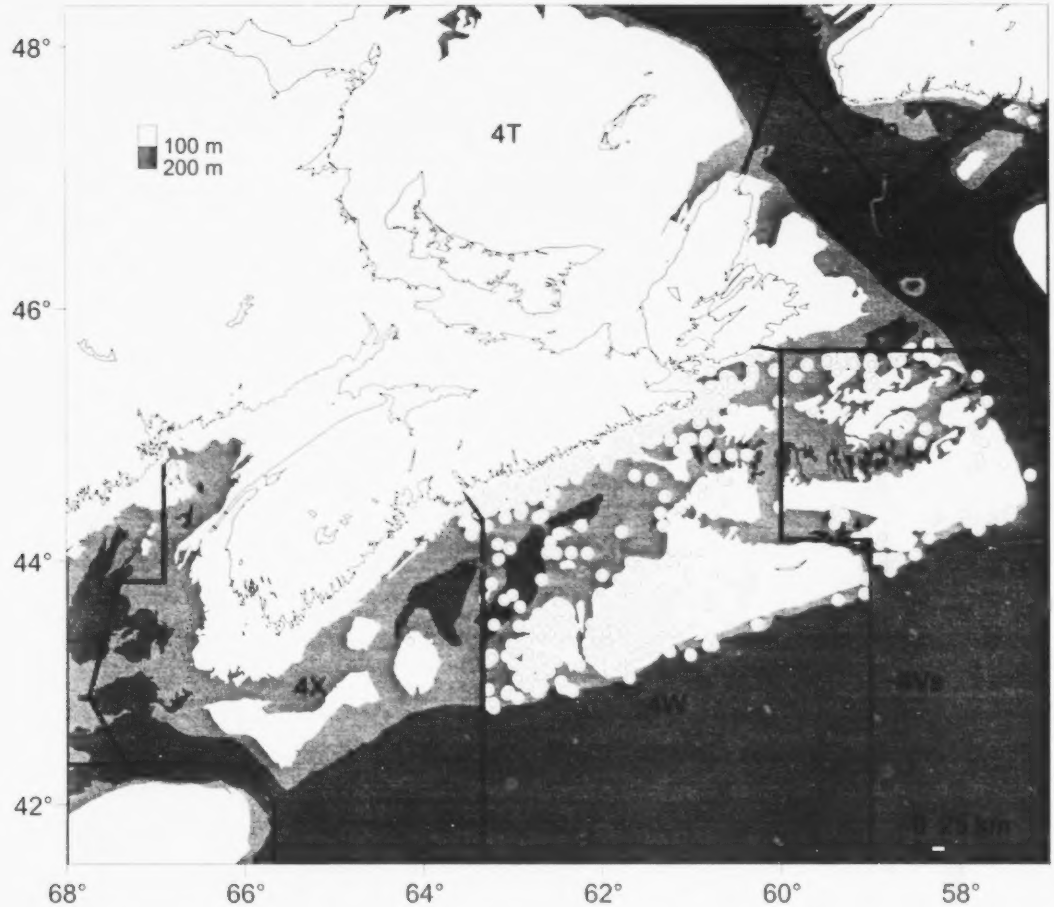

Figure 3.7.1: Map of sampling locations from SS, JSS, CI and CS. This map represents 531 of 640 set locations, which had positional information.

Table 3.7.2: Results of species accumulation curves for species collected during the CI and CS portion of the 4VsW Sentinel Surveys. For each species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

	All		
Species	n	min	nprey
Atlantic cod	2413	**0.01**	60
Cusk	23	0.22	10
Haddock	538	**0.02**	51
Pollock	28	0.18	11
Spiny dogfish	21	0.24	8
White hake	104	**0.05**	16

3.8 Pollock Surveys (POK)- 1983-1985

The purpose of the Pollock surveys was to determine the distribution and abundance of pollock on the Scotian Shelf and George's Bank. The surveys were conducted in November and December of 1983-1985 across 4VsWX5Z (Figure 3.8.1). Stomach samples were collected on some surveys, those with contents were excised placed in nylon stockings and immersed in 10% formalin for later analysis.

References

Annand, C. 1987. Cruise Report: Alfred Needler – N082. Department of Fisheries and Oceans, 13 pp.

McGlade, J. 1986. Cruise Report: Lady Hammond – H147. Department of Fisheries and Oceans, Atlantic Fisheries Service, Marine Fish Division, Fisheries Research Branch, Scotia-Fundy Region, 5 pp.

3.8.1 Summary of POK data

A total of 1834 stomachs were collected from 6 species, however only pollock, white hake, Atlantic cod and spiny dogfish were sampled with any intensity (Table 3.8.1). Of these, pollock, and white hake were represented by sufficient numbers for representative descriptions of diet (Table 3.8.2). Spiny dogfish had a SAC <0.05, but was only represented by a small sample size with few prey items, suggesting their diet is not fully described.

This data source possesses 26 distinct prey items covering 20 family groups in six phyla. There were 586 stomachs that had prey items but did not possess any fullness code. Of the species identified 89% of fish were detailed to species level whereas, 16% of invertebrates were to species.

Table 3.8.1: Count of stomachs analysed during the Pollock Surveys.

	Year			
Species	1983	1984	1985	Total
Atlantic cod	.	.	58	58
Haddock	.	.	7	7
White hake	.	742	.	742
Pollock	230	185	449	864
Redfish	.	.	3	3
Spiny dogfish	.	.	160	160
Total	230	927	677	1834

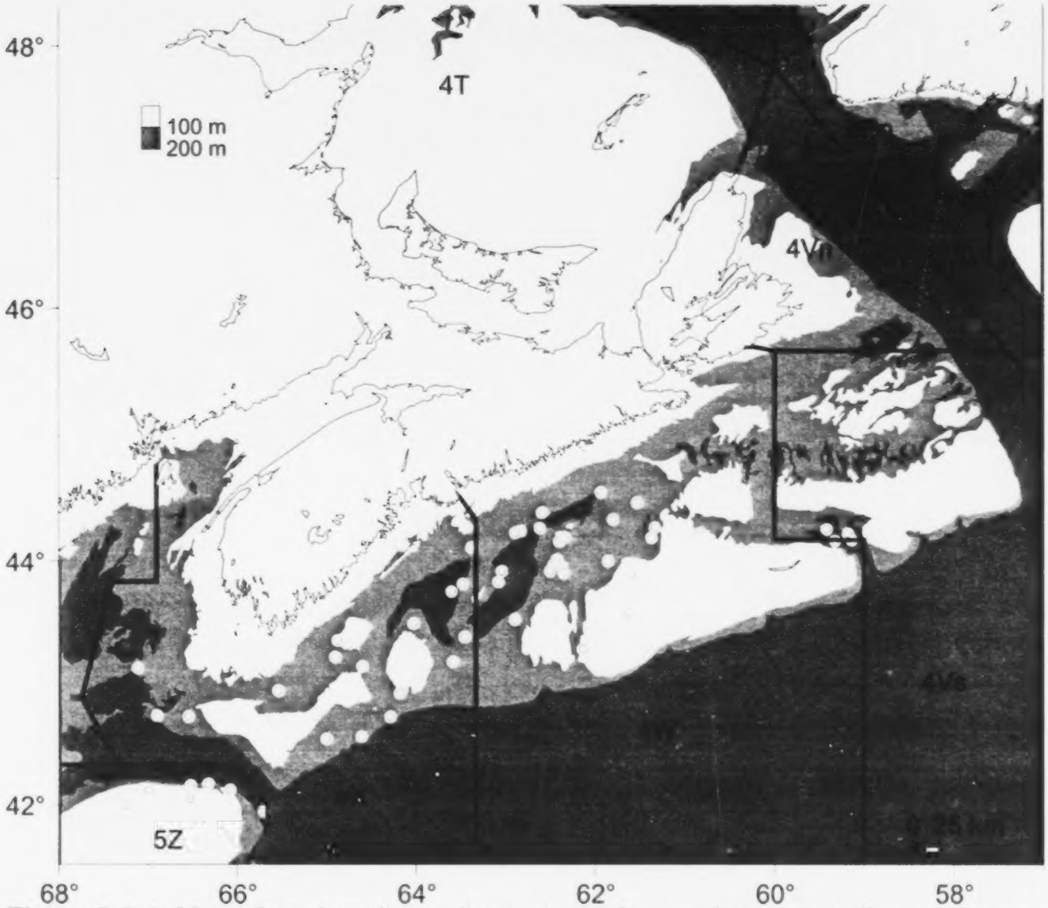

Figure 3.8.1: Map of set locations where stomach samples were collected during Pollock Surveys. This map represents 72 of 78 set locations; the remainder did not have positional information.

Table 3.8.2: Results of species accumulation curves for species collected during the Pollock Surveys. For each region and species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

	All			4VW			4X		
Species	n	min	nprey	n	min	nprey	n	min	nprey
Pollock	217	0.01	17	74	0.03	11	35	0.03	10
Spiny dogfish	48	0.04	4	.	.	.	.	.	.
White hake	111	0.05	10	92	0.05	10	.	.	.

3.9 Halibut Surveys (HS) – 1999-2001

The halibut industry long-line survey was conducted from May to July in NAFO Divisions 3NOPs4VsWX (Figure 3.9.1). Stomachs were collected on a length stratified basis and those with contents were frozen in brine for analysis back in the lab by FSRS technicians.

References

Zwanenburg, K., S. Wilson, R. Branton, and P. Brien. 2003. Halibut on the Scotian Shelf and Southern Grand Banks - Current Estimates of Population Status. Canadian Science Advisory Secretariat. Research Document 2003/046. 32pp.

Zwanenburg, K.C.T., and S. Wilson, 2000. The Scotian Shelf and Southern Grand Banks Atlantic Halibut (*Hippoglossus hippoglossus*) survey - Collaboration between the fishing and fisheries science communities, ICES CM 2000/W:20.

3.9.1 Summary of HS data

A total of 285 stomachs were collected from five species with the majority being from Atlantic halibut (246; Table 3.9.1). The diet of Atlantic halibut can be described using this dataset as sample sizes gave sufficient resolution of the prey items (Table 3.9.2). The prey identified in this data source represents 64 prey items from 39 family groupings in 8 phyla. Of the prey items identified 85% of fish were to species level whereas 11% of invertebrates were species.

Table 3.9.1: Count of stomachs examined from the Halibut Survey.

	Year			
Species	1999	2000	2001	Total
Atlantic cod	1	3	22	26
White hake	2	7	2	11
Cusk	1	.	.	1
Atlantic halibut	99	87	60	246
American Plaice	1	.	.	1
Total	104	97	74	285

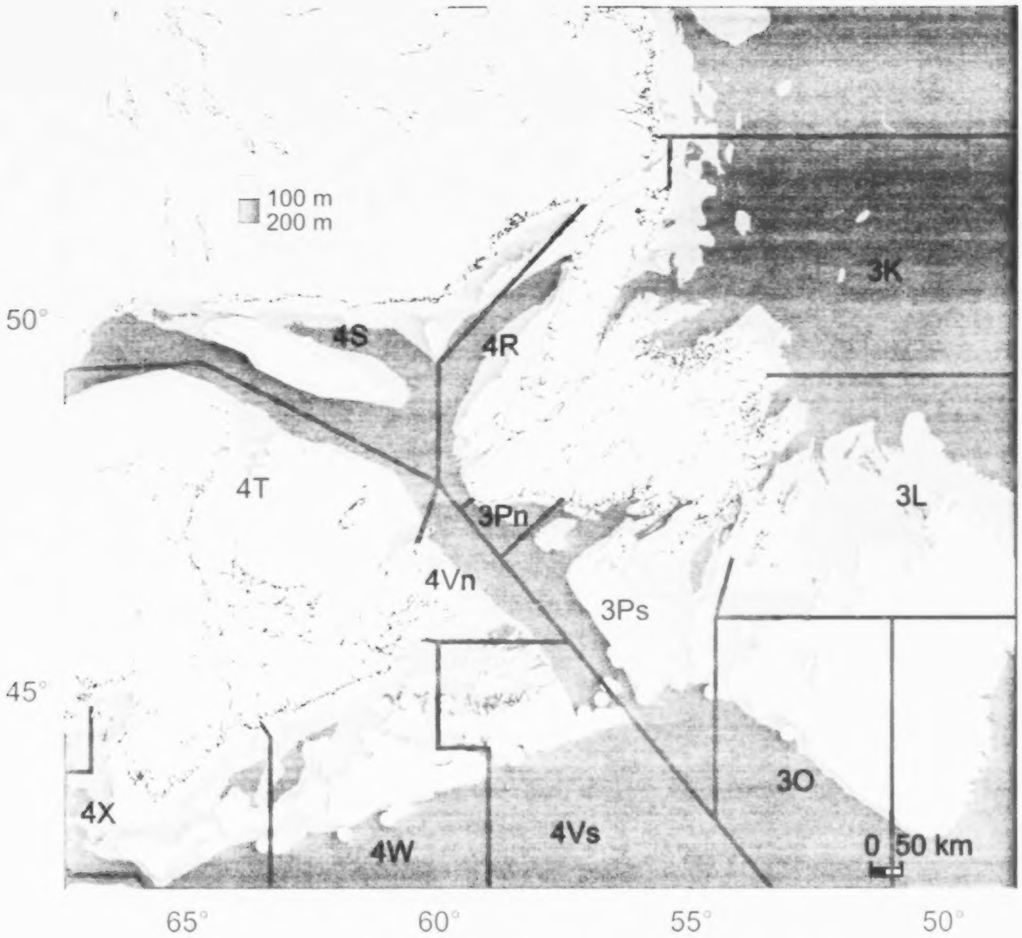

Figure 3.9.1: Set locations of stomach samples collected during the Halibut Surveys, grey line represents survey boundaries. Map represents 162 of 166 sets, the remainder does not have positional information.

Table 3.9.2: Results of species accumulation curves for species collected during the Halibut Survey (HS). For each region and species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

	All			4VW			4X		
Species	n	min	nprey	n	min	nprey	n	min	nprey
Atlantic cod	23	0.3	13	-	-	-	-	-	-
Atlantic halibut	246	**0.04**	34	172	**0.03**	24	37	0.19	19

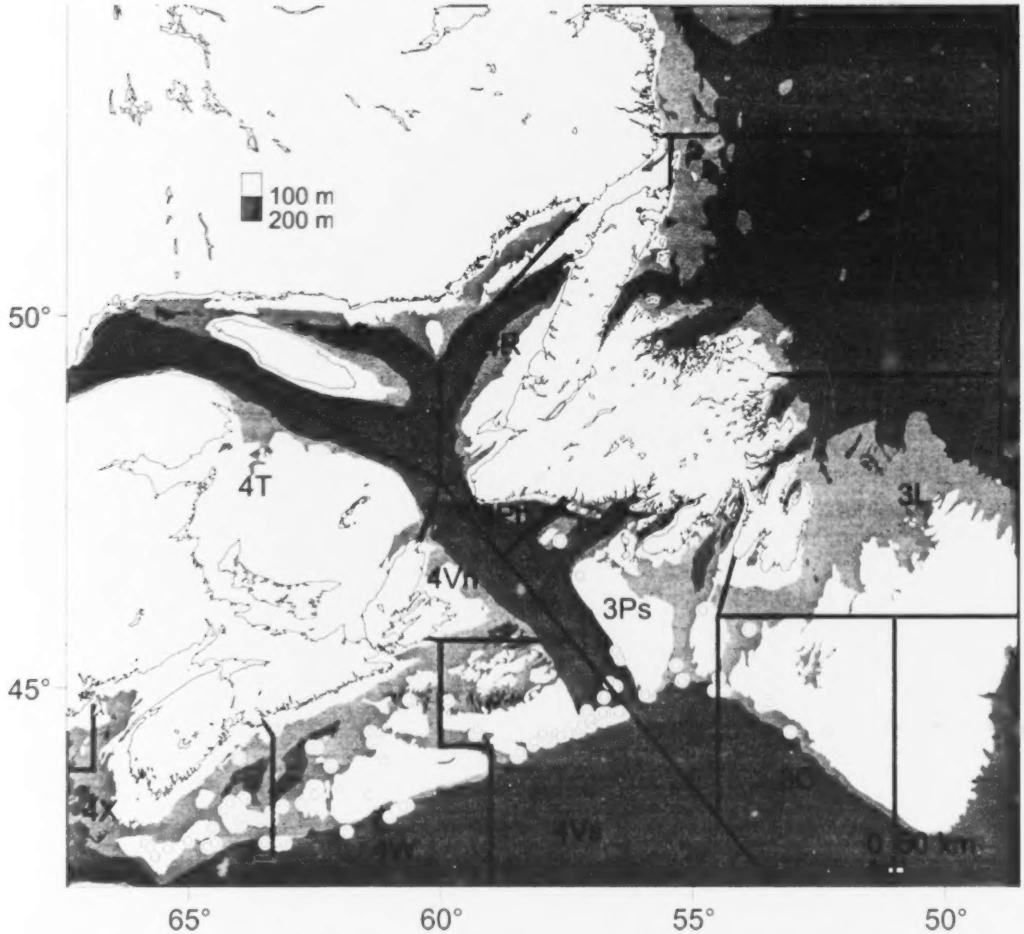

Figure 3.9.1: Set locations of stomach samples collected during the Halibut Surveys, grey line represents survey boundaries. Map represents 162 of 166 sets, the remainder does not have positional information.

Table 3.9.2: Results of species accumulation curves for species collected during the Halibut Survey (HS). For each region and species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

	All			4VW			4X		
Species	n	min	nprey	n	min	nprey	n	min	nprey
Atlantic cod	23	0.3	13	.	.	.	.	.	.
Atlantic halibut	246	0.04	34	172	0.03	24	37	0.19	19

3.10 Trawl Impact Study (TIS) - 1999

The purpose of this study was to determine the effects of mobile fishing gear on benthic habitat and demersal species. Multiple tows were conducted over the same area within the closed haddock box in NAFO Division 4WX (Figure 3.10.1). Stomachs were collected throughout this survey, frozen and analysed in the lab. Diet data should be used cautiously as the disturbance of multiple tows increased the availability of some prey items.

References

Kenchington,E.L., D.C. Gordon, C. Bourbonnais-Boyce, K.G. MacIsaac, K.D. Gilkinson, D.L. McKeown and W.P. Vass, Effects of experimental otter trawling on the feeding of demersal fish on Western Bank, Nova Scotia, *Amer. Fish. Soc. Symp.* 41 (2005), pp. 391–409.

3.10.1 Summary of TIS data

A total of 310 stomachs from seven species were examined (Table 3.10.1). Of those, only haddock and winter flounder had sufficient sample sizes to adequately describe diets (Table 3.10.2). Diet data consisted of 57 prey items from 45 family groups and 10 phyla. Of the prey items identified 78% of fish were to species level whereas 11% of invertebrates were to species.

Table 3.10.1: Count of stomachs collected during the Trawl Impact Survey that are in the Stomach Database.

Species	Total
Atlantic cod	59
Haddock	270
Pollock	1
American plaice	3
Winter flounder	245
Longhorn sculpin	23
Sea raven	1
Total	602

Table 3.10.2: Results of species accumulation curves for species collected during the Trawl Impact Survey (TIS). For each species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

		All	
Species	n	min	nprey
Atlantic cod	59	0.13	31
Haddock	265	0.03	39
Longhorn sculpin	23	0.21	17
Winter flounder	245	0.02	28

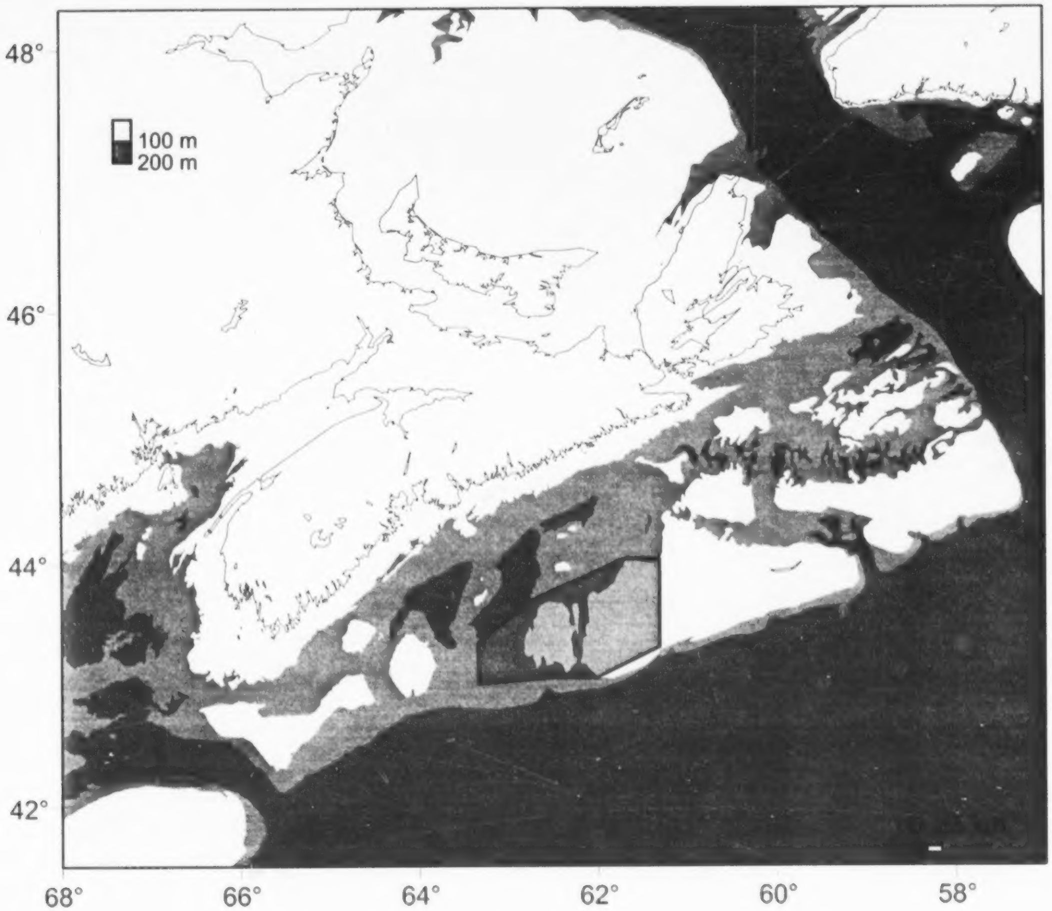
100 m
200 m
48°
46°
44°
42°
68°
66°
64°
62°
60°
58°

Figure 3.10.1: The trawl impact survey was conducted within the closed 4W haddock box (shaded area).

3.11 Juvenile Fish Survey (SP) - 1988

This survey was focussed on studying the occurrence of juvenile fish in basins on the Scotian Shelf and their relationships with high zooplankton concentrations. The samples were mainly from LaHave and Emerald basins in NAFO Divisions 4WX as well as Georges Bank, however there are a significant number of sets that do not have positional information (56 of 93; Figure 3.11.1). Whole fish and fish stomachs were preserved in formalin and were analysed at a later date.

References

Neilson, J. 1988. Cruise Report: Alfred Needler – N104. Department of Fisheries and Oceans, Marine Fish Division, Biological Sciences Branch, Science Sector, 4 pp.

Sameoto, D., J. Neilson, and D. Waldron. 1994. Zooplankton prey selection by juvenile fish in Nova Scotian shelf basins. Journal of Plankton Research. 16(8): 1003-1019.

3.11.1 Summary of SP data

A total of 579 stomachs from 23 species were collected (Table 3.11.1). Several of the predator species possessed SAC's with rates <0.05, however, the sample sizes were low and the prey items were described to only broad taxonomic detail suggesting the prey breadth is not fully described (Table 3.11.2). Overall, the 22 prey items were identified from 18 families and seven phyla. Of the prey items identified 57% of fish were identified to species whereas 7% of invertebrates were to species.

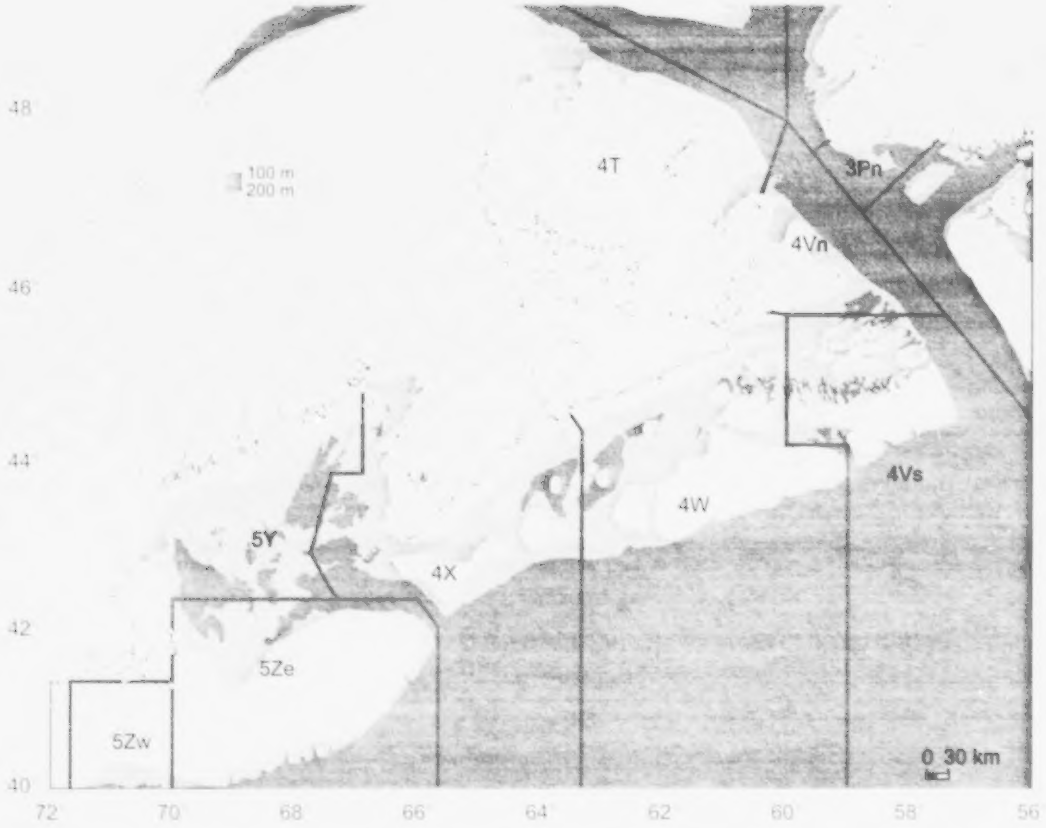
48
46
44
42
40
72
70
68
66
64
62
60
58
56
100 m
200 m
4T
3Pn
4Vn
4Vs
4W
4X
5Y
5Ze
5Zw
0 30 km

Figure 3.11.1: Map of set locations where stomach samples were collected during the Juvenile Fish Survey. Map represents 37 of 93 set locations; the remainder of sets do not have positional information.

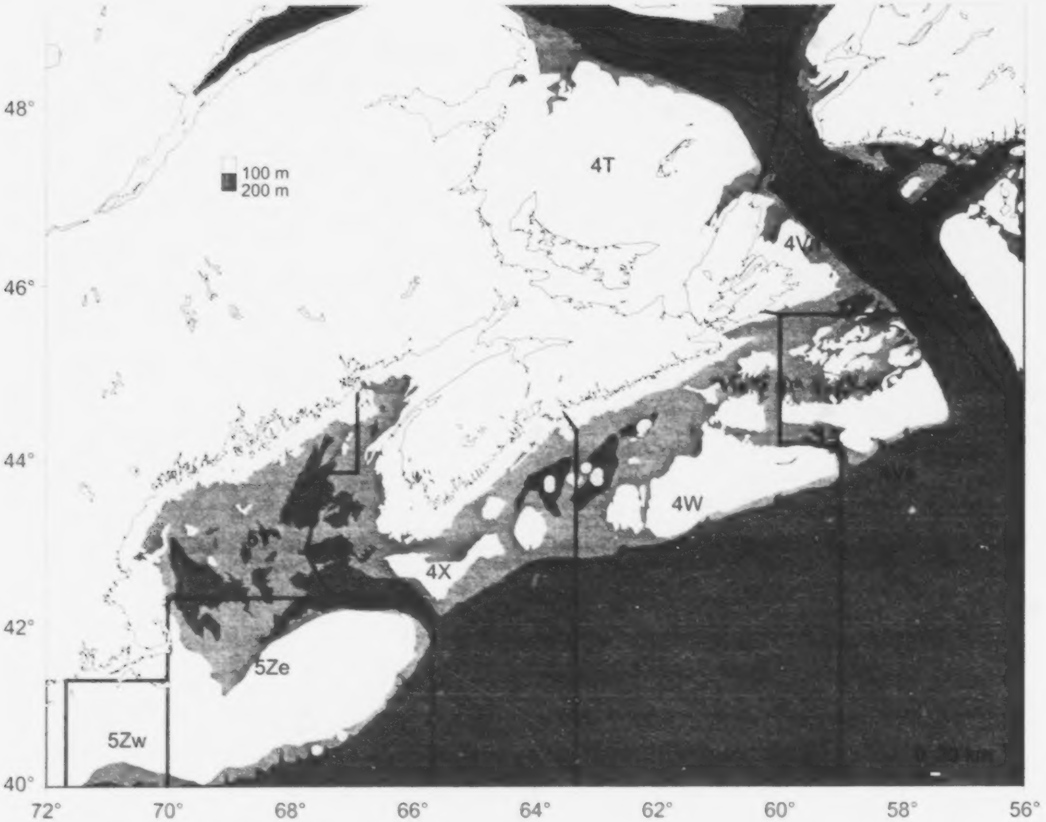
48°
46°
44°
42°
40°
72°
70°
68°
66°
64°
62°
60°
58°
56°
100 m
200 m
4T
4Vn
4Vs
4W
4X
5Ze
5Zw

Figure 3.11.1: Map of set locations where stomach samples were collected during the Juvenile Fish Survey. Map represents 37 of 93 set locations; the remainder of sets do not have positional information.

Table 3.11.1: Count of stomachs examined during the Juvenile Fish Surveys

Species	Total
Alewife	3
American plaice	10
Argentine	25
Atlantic cod	21
Butterfish	2
Cusk	3
Fourbeard rockling	3
Haddock	20
Herring	1
Longfin hake	4
Mackerel	5
Monkfish	16
Offshore hake	3
Pollock	62
Red hake	55
Redfish	9
Sandlance	3
Silver hake	132
Smooth skate	1
Spiny dogfish	150
Thorny skate	2
White hake	42
Witch flounder	7
Total	579

Table 3.11.2: Results of species accumulation curves for species collected during the Juvenile Fish Survey (SP). For each species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed. Grey shaded boxes represent minimum rates of change of ≤0.05 for species accumulation curves.

Species	n	Min	nprey
Pollock	42	0.02	7
Red hake	20	0.05	5
Silver hake	61	0.03	5
Spiny dogfish	67	0.01	4
White hake	16	0.31	7

3.12 Browns Bank Survey (BB)- 2000

During the February, 2000 survey of Georges Bank, stomachs were collected from a single set on Browns Bank using a Western IIA bottom trawl (Figure 3.12.1). Stomachs were frozen in brine and returned to the lab for processing.

3.12.1 Summary of BB data

A total of 242 Atlantic cod and haddock stomachs were sampled (Table 3.12.1). Neither species were sampled with high enough intensity to produce an asymptotic species accumulation curve (Table 3.12.2).There were 32 prey items identified from 27 family groups in seven phyla. Of the prey items identified 83% of fish were to species whereas 17% of invertebrates were to species.

Table 3.12.1: Stomachs in the database from the Browns Bank Survey.

Species	Total
Atlantic cod	75
Haddock	167
Total	242

Table 3.12.2: Results of species accumulation curves for species collected during the Browns Bank Survey (BB). For each species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed.

Species	n	min	nprey
Atlantic cod	75	0.09	18
Haddock	100	0.09	21

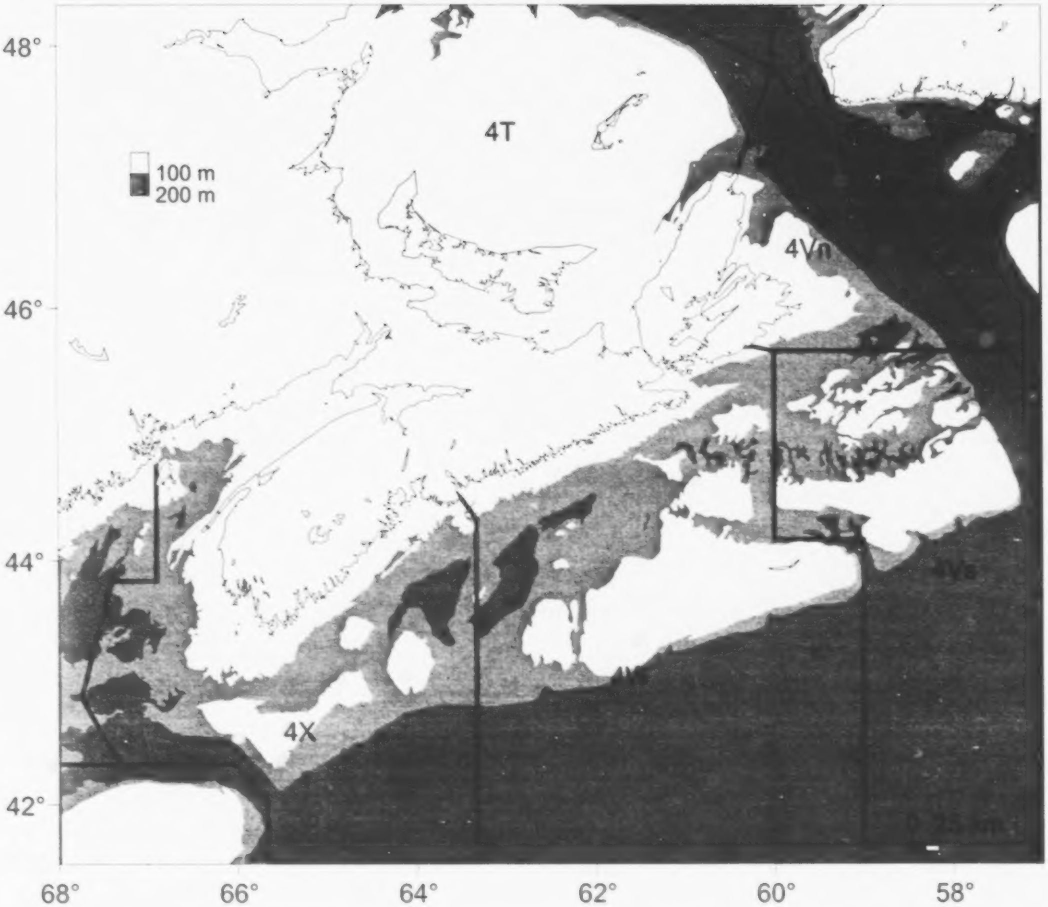
48°
46°
44°
42°
4T
100 m
200 m
4Vn
4Vs
4W
4X
68°
66°
64°
62°
60°
58°

Figure 3.12.1: Map of sample location from stomach samples on Browns bank collected during the spring Georges Bank survey in year 2000.

3.13 Commercial Fishing (CMF)- 2001

During April and May of 2001, longhorn sculpin stomachs were collected from seven directed commercial fishing sets in St. Mary's Bay (Figure 3.13.1). Stomachs were frozen in brine and analysed later in the lab by FSRS technicians.

3.13.1: Summary of CMF data

A total of 167 longhorn sculpin stomachs were collected. The samples were not sufficient to produce an asymptotic species accumulation curve, suggesting the diet is not fully described. The diet information consisted of 30 prey items from 25 family groups in seven phyla. Of the prey items identified 20% of fish were to species level whereas 9% of invertebrates were to species.

Table 3.13.1: Results of species accumulation curves for species collected during the Commercial Fishing Trips (CMF). The number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed.

Species	N	Min	N Prey
Longhorn sculpin	153	0.06	25

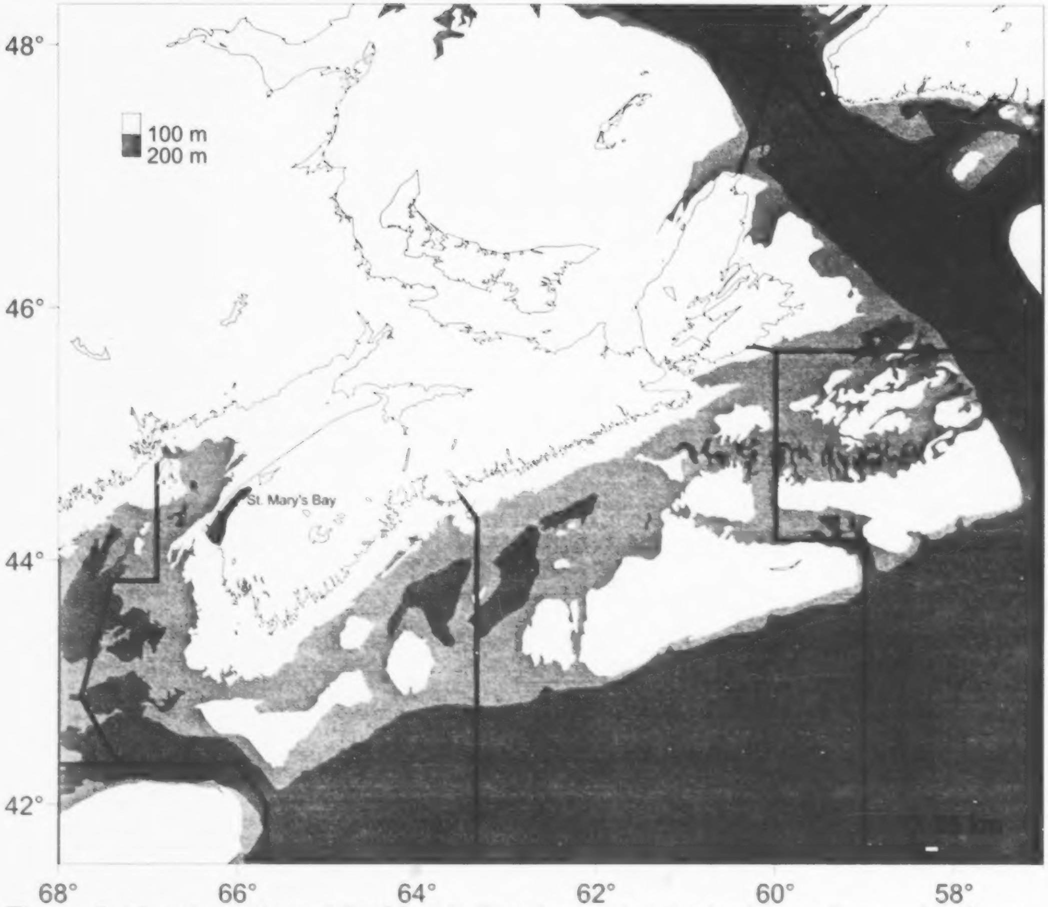
48°
46°
44°
42°
100 m
200 m
St. Mary's Bay
68°
66°
64°
62°
60°
58°

Figure 3.13.1: Location of St. Mary's Bay (grey shading) where all samples from the Commercial Fishing data source were collected.

3.14 Groundfish Port Samples (GPS)- 2001

Stomach samples were collected from commercial fish landings during port sampling on seven dates between March and September 2001, no sampling locations were provided. Samples were frozen and returned to BIO for processing.

3.14.1 Summary of GPS data

A total of 588 Atlantic cod and haddock stomach samples were collected. Both species were adequately sampled for description of food habits for the time period and area of sampling. Diet information consisted of 30 prey items from 25 family groupings in seven phyla. Of the prey items identified 70% were to species level, whereas 17% of invertebrates were to species.

Table 3.14.1: Stomach samples in the database collected during port sampling.

Species	Total
Atlantic cod	350
Haddock	238

Table 3.14.2: Results of species accumulation curves for species collected during Groundfish Port Sampling (GPS). For each species, the number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed.

Species	N	Min	N Prey
Atlantic cod	343	0.02	31
Haddock	186	0.03	20

3.15 Hydroacoustic Survey for Pollock (HSP)- 2002

During January and February 2002, a hydroacoustic survey of pollock was conducted in NAFO Divisions 4WX5Z (3.15.1). Pollock stomachs were collected from Campelen trawl deployments used to confirm species identification from the acoustic tracks. Stomachs were processed by FSRS technicians.

3.15.1 Summary of HSP data

A total of 410 pollock stomachs were examined, the majority of which were empty. Of the 75 stomachs that did contain prey, 8 items were identified from 7 families in 4 phyla. Of the prey items identified 66% (2 of 3) of fish were identified to species level whereas 25% (1 of 4) invertebrates were to species. The species accumulation curve was asymptotic, but was more likely due to low prey resolution than complete sampling (Table 3.15.1).

Table 3.15.1: Results of species accumulation curves for species collected during Hydroacoustic Pollock sampling (HSP). The number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed.

Species	N	Min	N Prey
Pollock	74	0.04	7

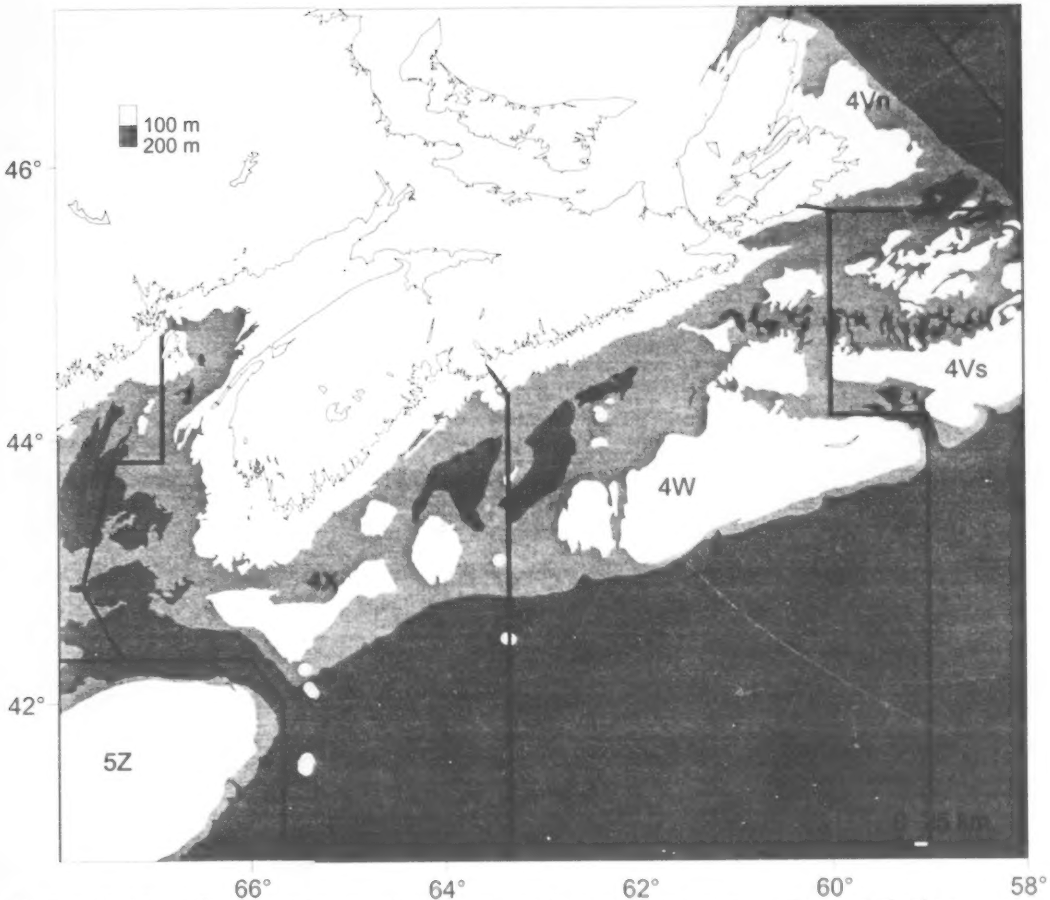
100 m
200 m
46°
44°
42°
4Vn
4Vs
4W
4X
5Z
66°
64°
62°
60°
58°

Figure 3.15.1: Set locations where stomach samples were collected during Hydroacoustic Pollock Surveys.

3.16 Porbeagle Fishery (PB)- 1999-2001

Porbeagle shark (*Lamna nasus*) stomachs were collected between February 1999 and January 2001 from commercial longline vessels and a long line vessel chartered for research purposes (Joyce et al. 2002). The areas fished change seasonally with the distribution of the fish with the effort being centered on Georges Bank and the Scotian Shelf in the spring and the Gulf of St. Lawrence and Grand Banks in the autumn (Campana et al. 1999; Figure 3.16.1). For consistency with the database structure, mission numbers were generated for each sampling date and set numbers where generated for each reported change in fishing location within a day as fishing used fixed longline gear with an 8 hour soak time (Joyce et al. 2002). Reported temperatures are surface temperatures.

Stomach fullness was first determined by external manipulation of the stomach wall, and if contents were identified the stomach was excised, and frozen for later analysis. During analyses prey item identification was done to the lowest possible taxon using Scott and Scott (1988) and Vecchione et al. (1989).

References

Campana, S. E., Marks, L., Joyce, W. N., Hurley, P. C. F., Showell, M., and Kulka, D. 1999. An analytical assessment of the porbeagle shark (*Lamna nasus*) Population in the northwest Atlantic. Department of Fisheries and Oceans Atlantic Fisheries Research Document, 96/24.

Joyce, W., S. E. Campana, L. J. Natanson, N. E. Kohler, H. L. Pratt, and C. F. Jensen. 2002. Analysis of stomach contents of the porbeagle shark (*Lamna nasus*) in the northwest Atlantic. ICES J. Mar. Sci., 59: 1263-1269.

3.16.1 Summary of PB data

Of the 1150 porbeagle shark stomachs examined, 495 contained prey items. There were 32 items represented consisting of 25 family groups from four phyla. Of the prey items identified 72% of fish were to species level, whereas 33% of invertebrates were to species. The SAC was asymptotic suggesting that the prey breadth of porbeagle sharks was adequately described.

Table 3.16.1: Results of species accumulation curves for species collected during porbeagle sampling (PB). The number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed.

Species	N	Min	N Prey
Porbeagle	495	0.01	25

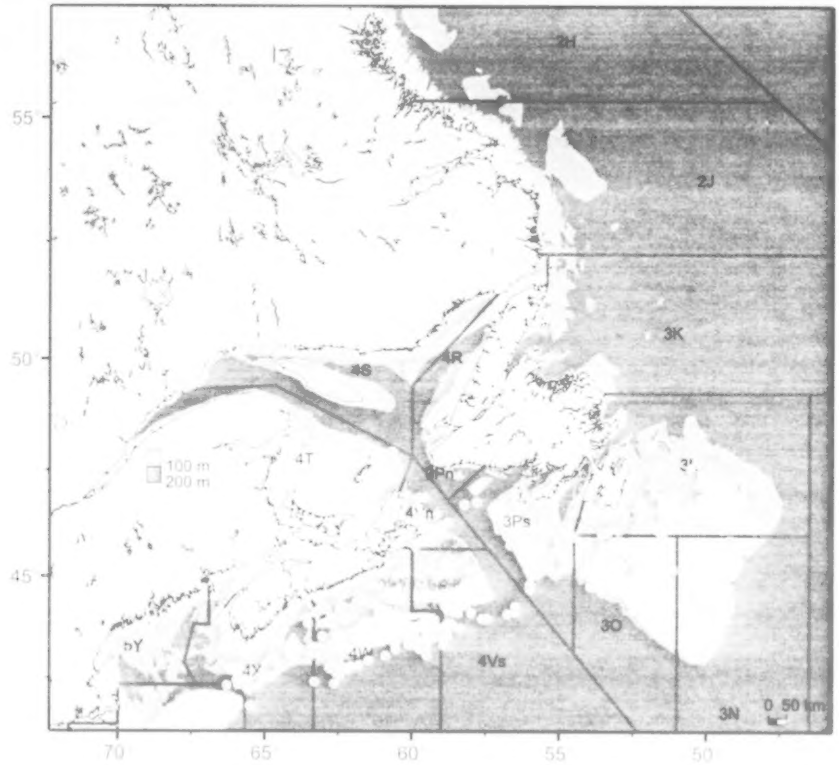
2H
2J
3K
4S
4R
3L
4T
100 m
200 m
3Pn
4Vn
3Ps
3O
4Vs
4X
5Y
3N
0 50 km
55°
50°
45°
70°
65°
60°
55°
50°

Figure 3.16.1: Distribution of porbeagle stomach samples from commercial longline vessels and a research survey between 1999 and 2001.

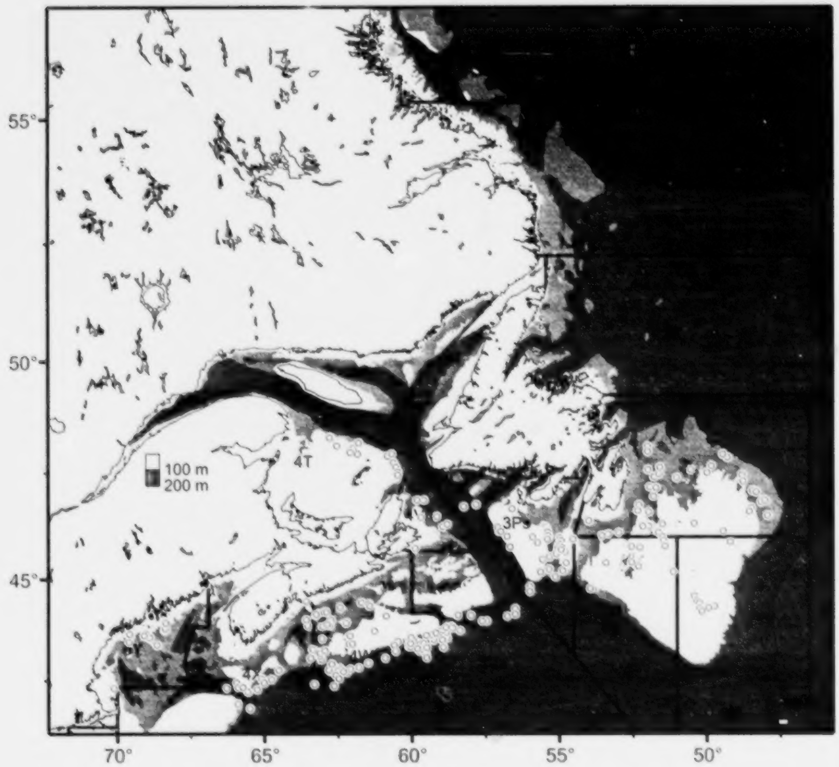
55°
50°
45°
70°
65°
60°
55°
50°
100 m
200 m
4T
3P

Figure 3.16.1: Distribution of porbeagle stomach samples from commercial longline vessels and a research survey between 1999 and 2001.

3.17 Recreational shark fishing derbies (SD)- 1999-2008

During rod and reel shark fishing tournaments stomachs were analysed dockside. Home ports for each of the shark derbies are shown in Figure 3.17.1, with positional location included for few trips in 2001 and 2002. Most of the fish examined were blue shark however some porbeagle, thresher and mako sharks were also analyzed (McCord and Campana 2003).

Mission numbers were generated for each year and home port for the fishing derby. Set numbers were generated for each day sampled at that derby as most days did not have positional data with the samples. When positional data was included, sets were allocated to each fishing location. Reported temperatures are surface temperatures. Stomach content volumes (ml) were recorded and added into the STOWGT column of the SDDET table. The corresponding empty weight (EMPTYWGT) for each of these records was set to 0 to reflect that volumes are only for contents.

References

McCord, M.E., S.E. Campana. 2003. A quantitative assessment of the diet of blue shark (*Prionace glauca*) off Nova Scotia, Canada. J. Northw. Atl. Fish. Sci. 32: 57-63.

3.17.1 Summary of the SD data

Of the 1452 blue shark stomachs examined 697 contained prey items. There were 48 prey items representing 29 family groups in 7 phyla. The blue shark prey breadth was adequately described with a minimum rate of change of 0.01 for the SAC.

Twenty-three mako stomachs were examined with 11 containing nine distinct prey items from eight family groups in four phyla. Of the prey items identified 61% of fish were to species level whereas 7% of invertebrates were to species.

Table 3.17.1: Count of stomachs examined during the Shark derbies

Species	Total
Porbeagle	11
Blue shark	1452
Thresher Shark	4
Mako shark	23
Total	1490

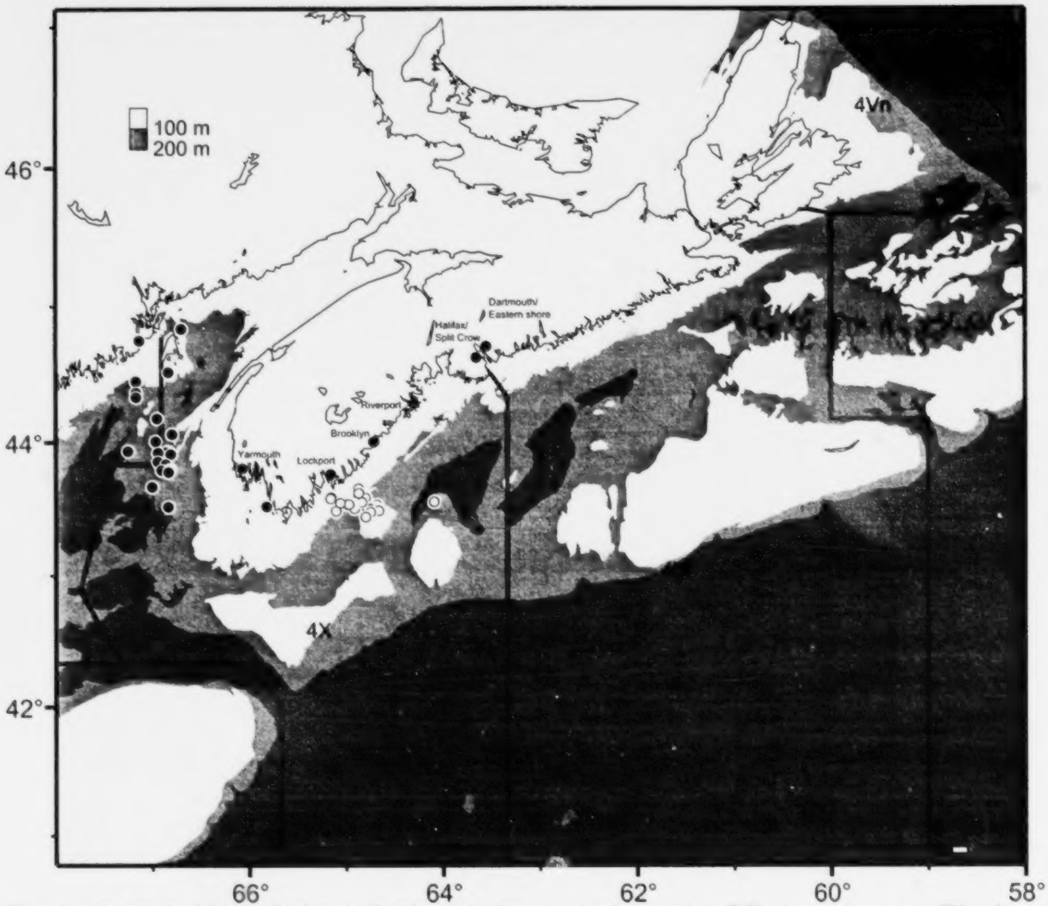
100 m
200 m
4Vn
Dartmouth/
Eastern shore
Halifax/
Split Crow
Riverport
Brooklyn
Yarmouth
Lockport
4X
46°
44°
42°
66°
64°
62°
60°
58°

Figure 3.17.1: Map of shark fishing derby ports from the SD datasource. Black circles represent fishing locations during the Yarmouth 2001 fishing derby and white are from the Lockport 2002 derby.

Table 3.17.2: Results of species accumulation curves for species collected during recreational shark fishing derbies (SD). The number of examined stomachs with prey items (n), the minimum rate of change from the species accumulation curve (min.) and the number of prey items identified (nprey) are listed.

Species	N	Min	N Prey
Blue shark	697	0.01	29
Mako shark	11	0.35	8

4. Diet Estimation

Diet was estimated from the food habits data in the GS data source for 12 species whose species accumulation curve had reached a minimum rate of change of <=0.01 (although we recognize that <=0.05 is our defined cut off for diet descriptions). Diets were described using the FAM category of the PREY_SPEC_DETAILS code table to group the prey items. Calculations follow those defined above (Section 2.2) which yielded mean (standard deviation) diet by weight as well as the percent composition.

The calculated estimates of diet were for the entire time series (1995-2008) over all seasons (spring and summer) and all regions (4VWX5Z). Based on the results of the SAC analyses, there were sufficient samples to estimate the diets of several species at finer spatial and temporal resolutions: however for the purpose of this report, which was to provide a general overview of the stomach database, we presented the data at a more aggregated level.

4.1 Description of results

Fin fish were the dominant prey of the gadids Atlantic cod, silver hake and white hake, as well as thorny skate. In contrast, invertebrates were the main components of Atlantic herring, capelin, mackerel, witch flounder and sand lance diets. Haddock, American plaice, and yellowtail flounder possessed a more intermediate diet, consuming significant proportions of both fin fish and invertebrates (Figures 4.1.1-4.1.12; Table 4.1.1). In rank order, white hake was the most piscivorous, followed by silver hake, thorny skate, Atlantic cod, haddock, American plaice, yellowtail flounder, capelin, mackerel, Atlantic herring, sand lance and witch flounder. Note that fish, or fish eggs are present in all predator diets described here.

The most frequently observed prey fish across the 12 predator species were ammodytidae followed by clupeidae, gadidae and merlucciidae. The most common prey invertebrates were the broad decapoda group, euphausiidae, and arthropoda. However, there was a much greater diversity of invertebrate prey observed across the predators than fin fish prey as 30 invertebrate family groups were identified compared to 14 fin fish groups (Figures 4.1.1-4.1.12; Table 4.1.1).

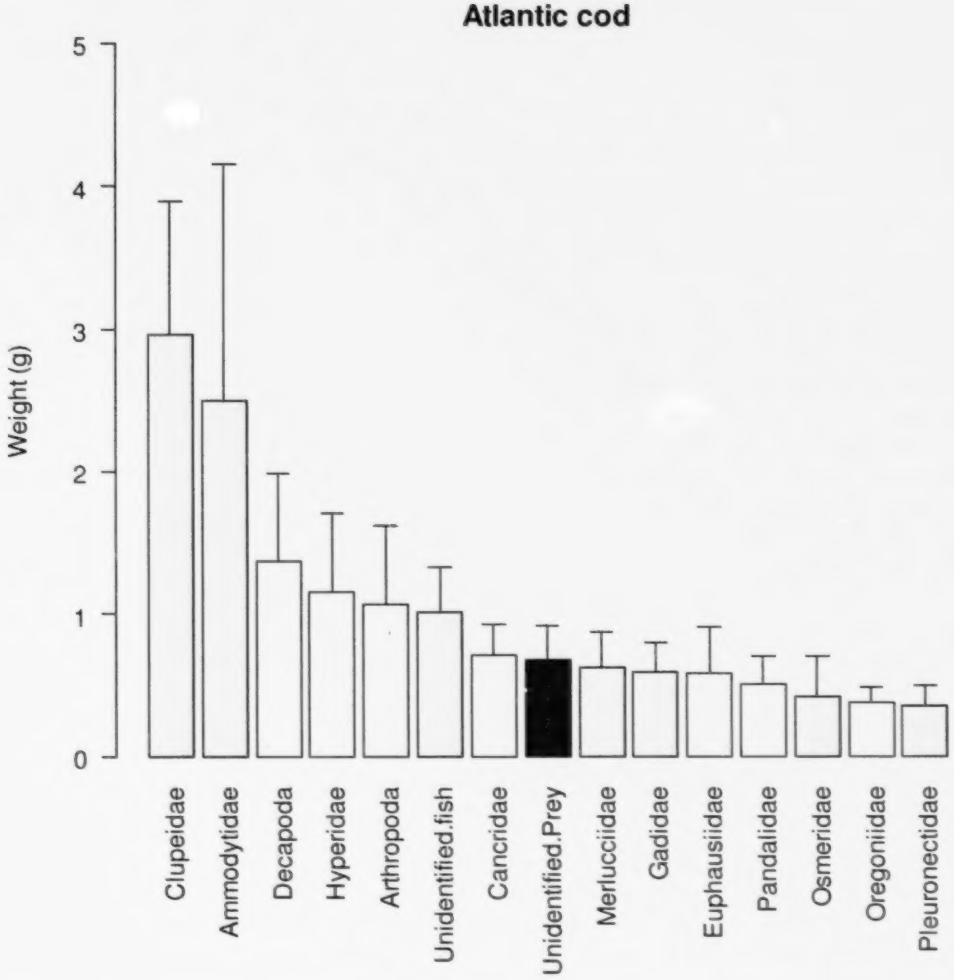

Figure 4.1.1- Mean (standard deviation) diet of Atlantic cod captured during RV surveys between 1995 and 2008. Green shading (grey) represent fin fish species, yellow (light grey) -invertebrates and plants and blue (black)-unidentified prey.

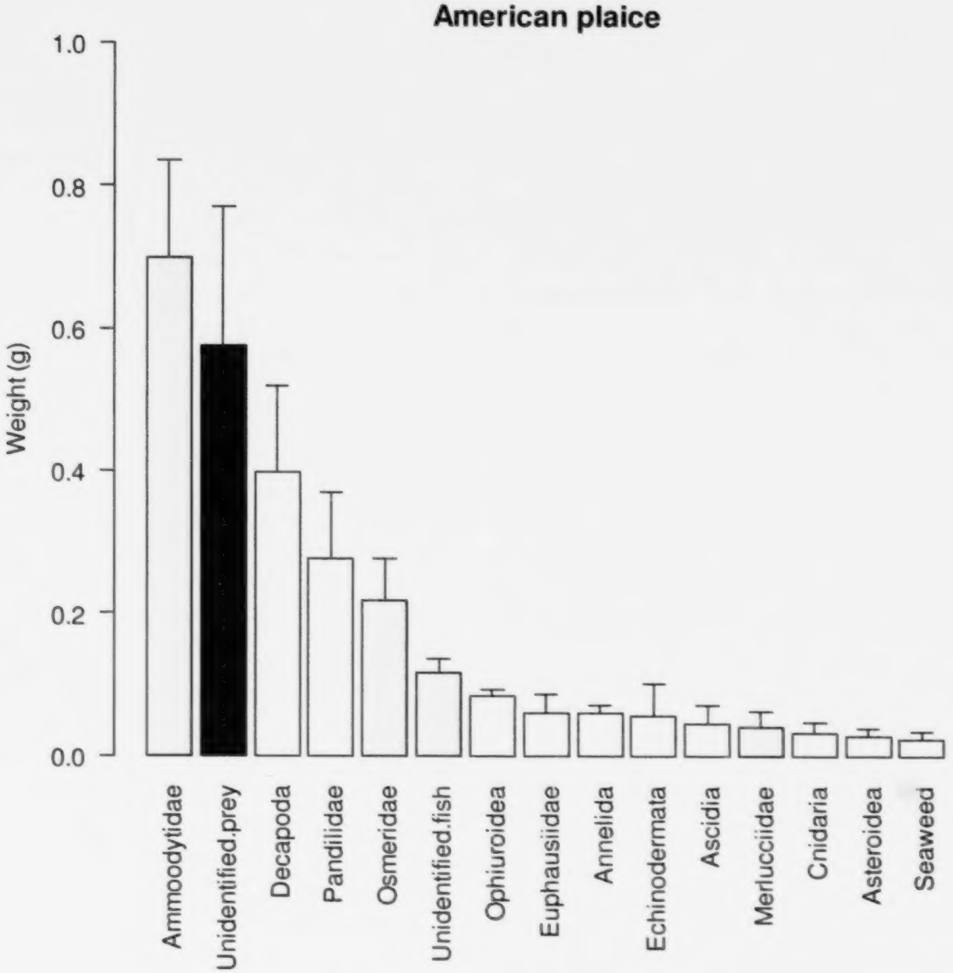

Figure 4.1.2- Mean (standard deviation) diet of American plaice captured during RV surveys between 1995 and 2008. Green (grey) shading represent fin fish species, yellow (light grey) -invertebrates and plants and blue (black)-unidentified prey.

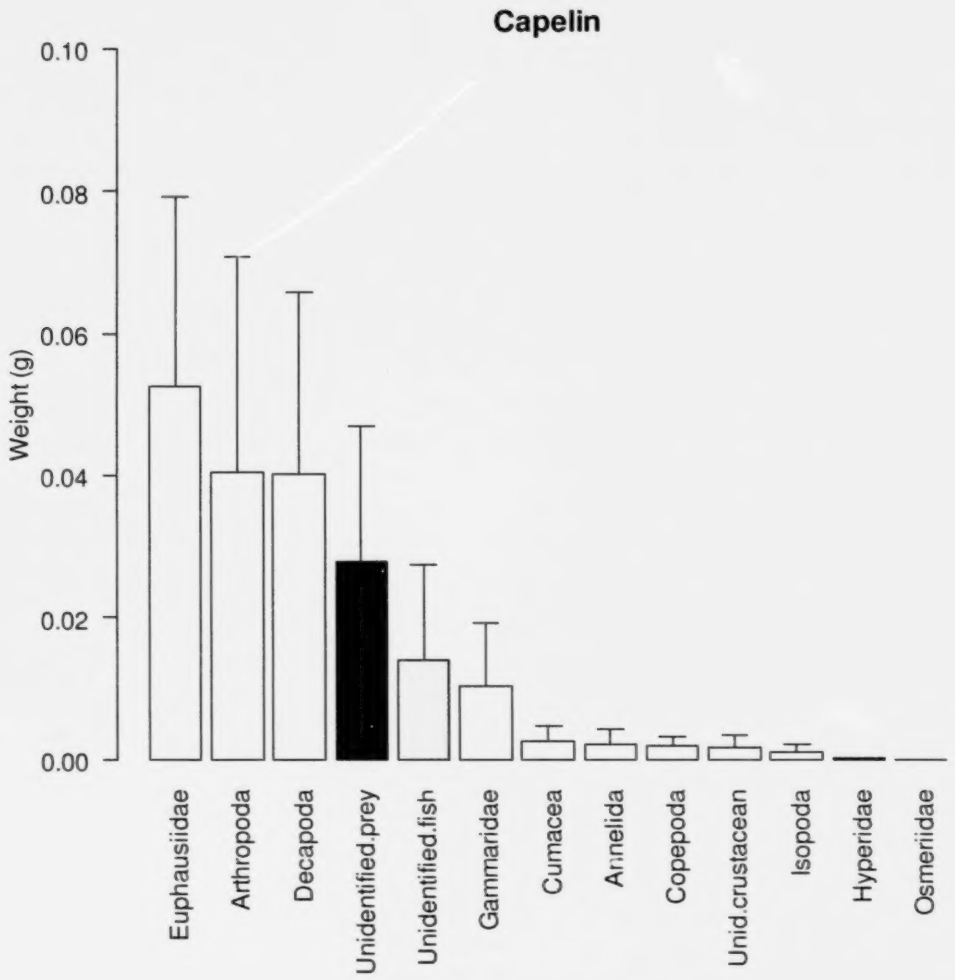

Figure 4.1.3- Mean (standard deviation) diet of capelin captured during RV surveys between 1995 and 2008. Green (grey) shading represent fin fish species, yellow (light grey) -invertebrates and plants and blue (black)-unidentified prey.

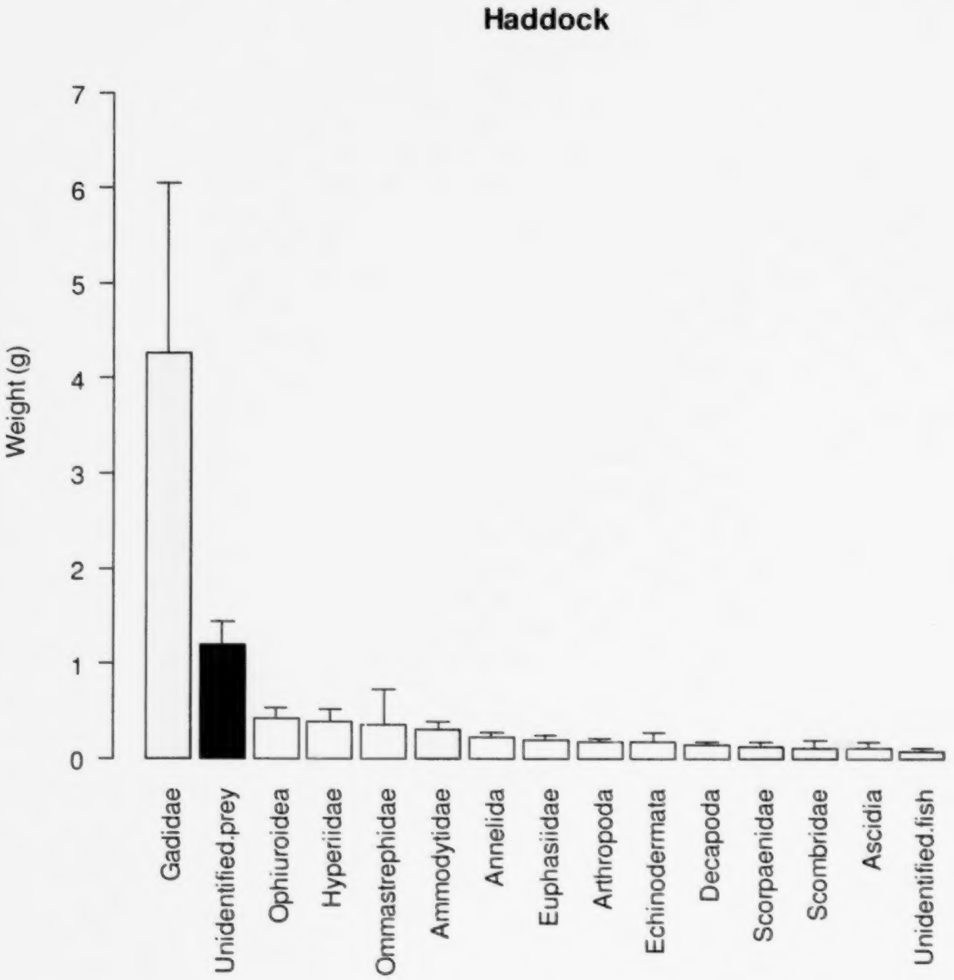

Figure 4.1.4- Mean (standard deviation) diet of haddock captured during RV surveys between 1995 and 2008. Green (grey) shading represent fin fish species, yellow (light grey) -invertebrates and plants and blue (black)-unidentified prey.

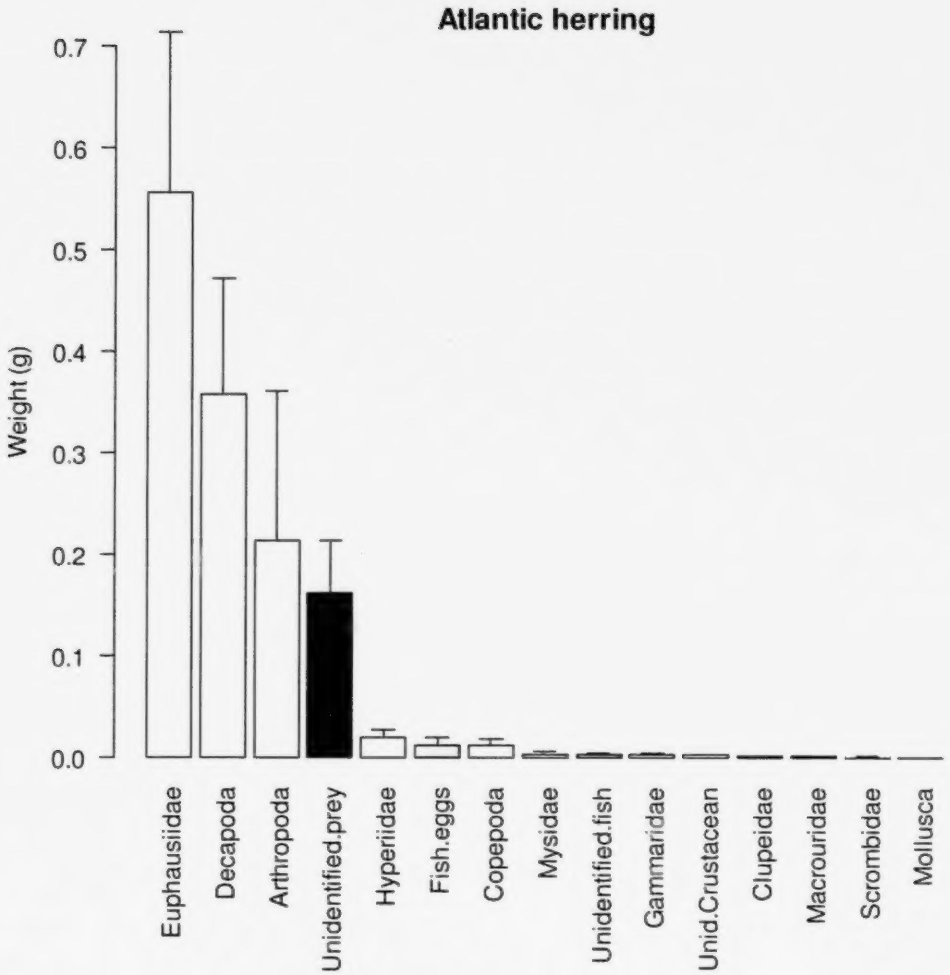

Figure 4.1.5- Mean (standard deviation) diet of Atlantic herring captured during RV surveys between 1995 and 2008. Green (grey) shading represent fin fish species, yellow (light grey) -invertebrates and plants and blue (black)-unidentified prey.

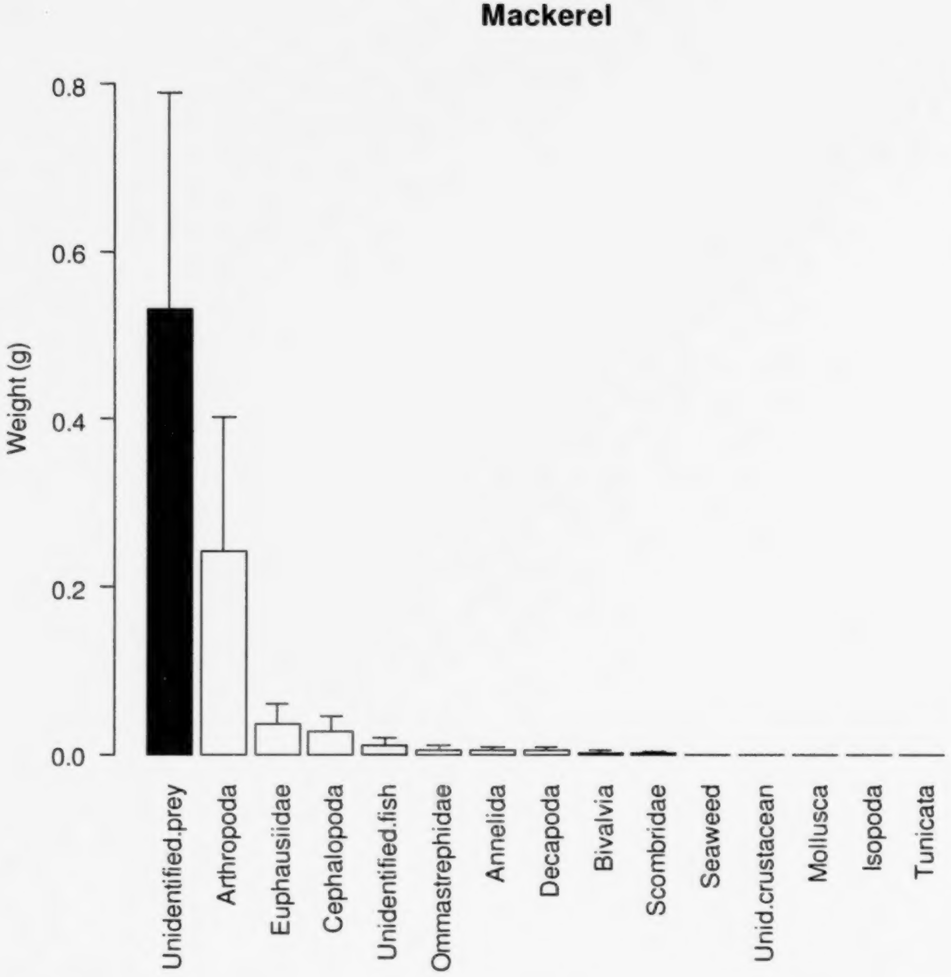

Figure 4.1.6- Mean (standard deviation) diet of mackerel captured during RV surveys between 1995 and 2008. Green (grey) shading represent fin fish species, yellow (light grey) -invertebrates and plants and blue (black)-unidentified prey.

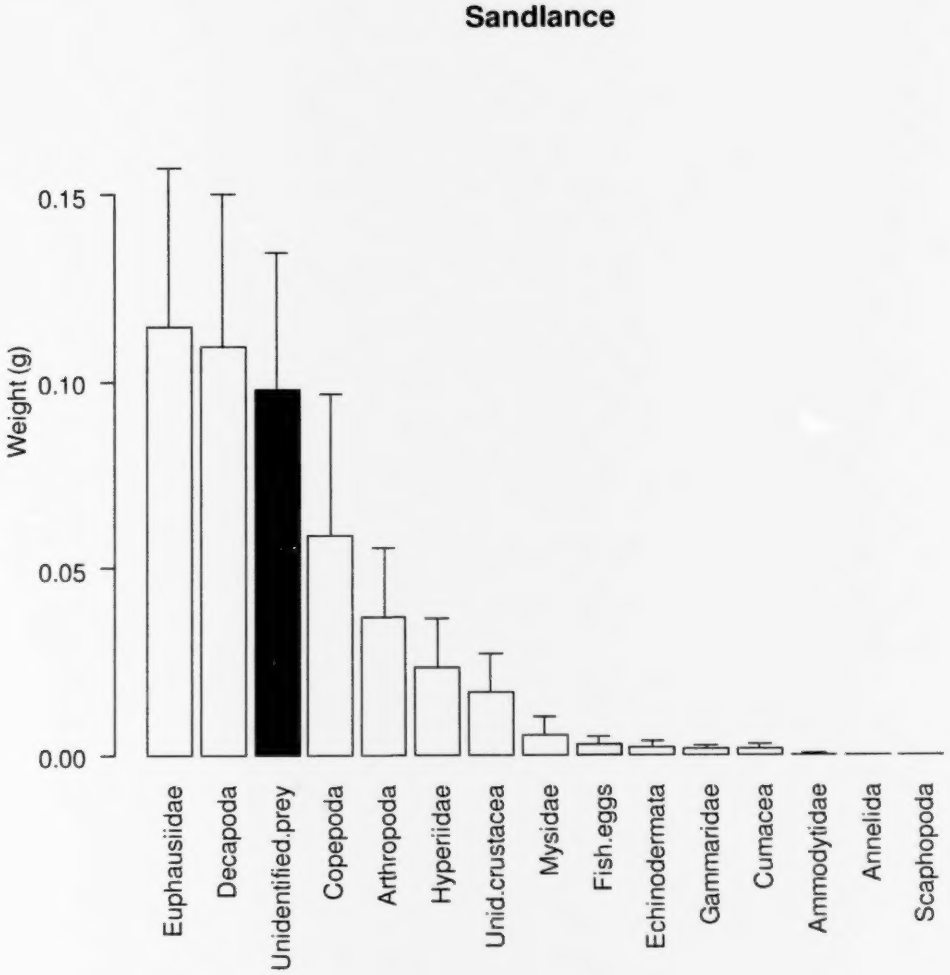

Figure 4.1.7- Mean (standard deviation) diet of sandlance captured during RV surveys between 1995 and 2008. Green (grey) shading represent fin fish species, yellow (light grey) -invertebrates and plants and blue (black)-unidentified prey.

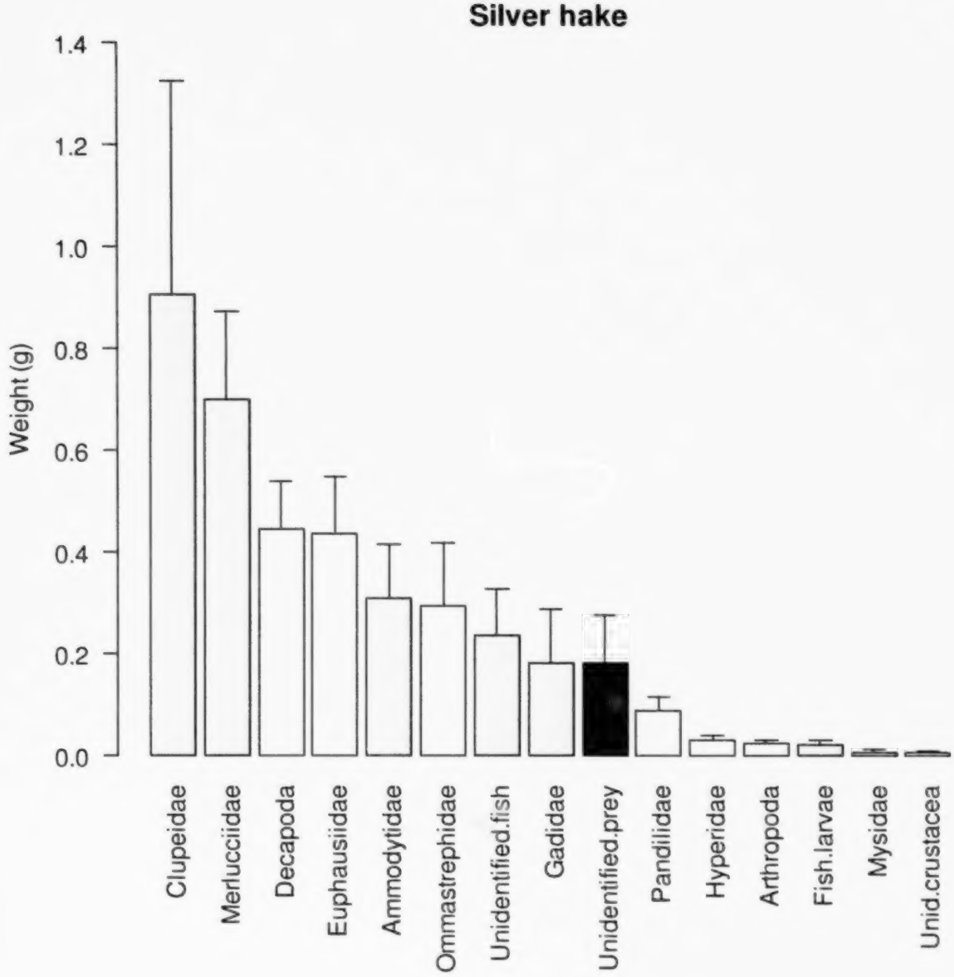

Figure 4.1.8- Mean (standard deviation) diet of silver hake captured during RV surveys between 1995 and 2008. Green (grey) shading represent fin fish species, yellow (light grey) -invertebrates and plants and blue (black)-unidentified prey.

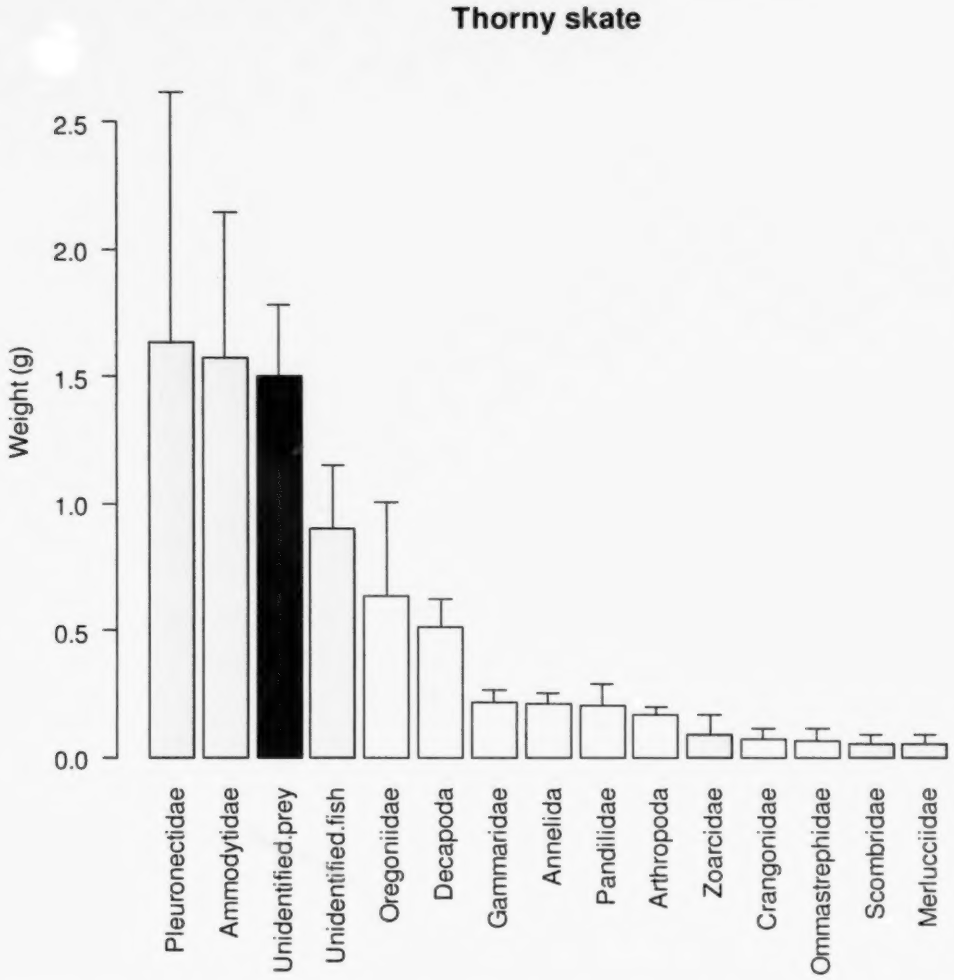

Figure 4.1.9- Mean (standard deviation) diet of thorny skate captured during RV surveys between 1995 and 2008. Green (grey) shading represent fin fish species, yellow (light grey) -invertebrates and plants and blue (black)-unidentified prey.

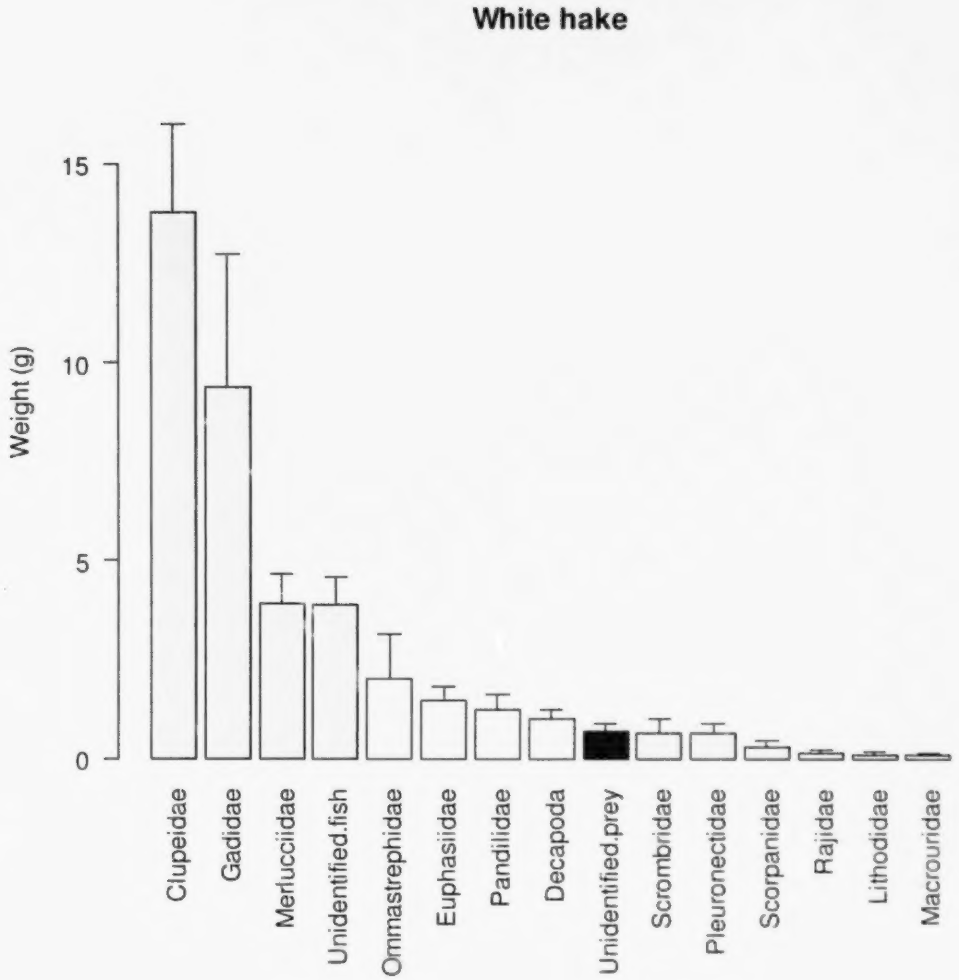

Figure 4.1.10- Mean (standard deviation) diet of white hake captured during RV surveys between 1995 and 2008. Green (grey) shading represent fin fish species, yellow (light grey) -invertebrates and plants and blue (black)-unidentified prey.

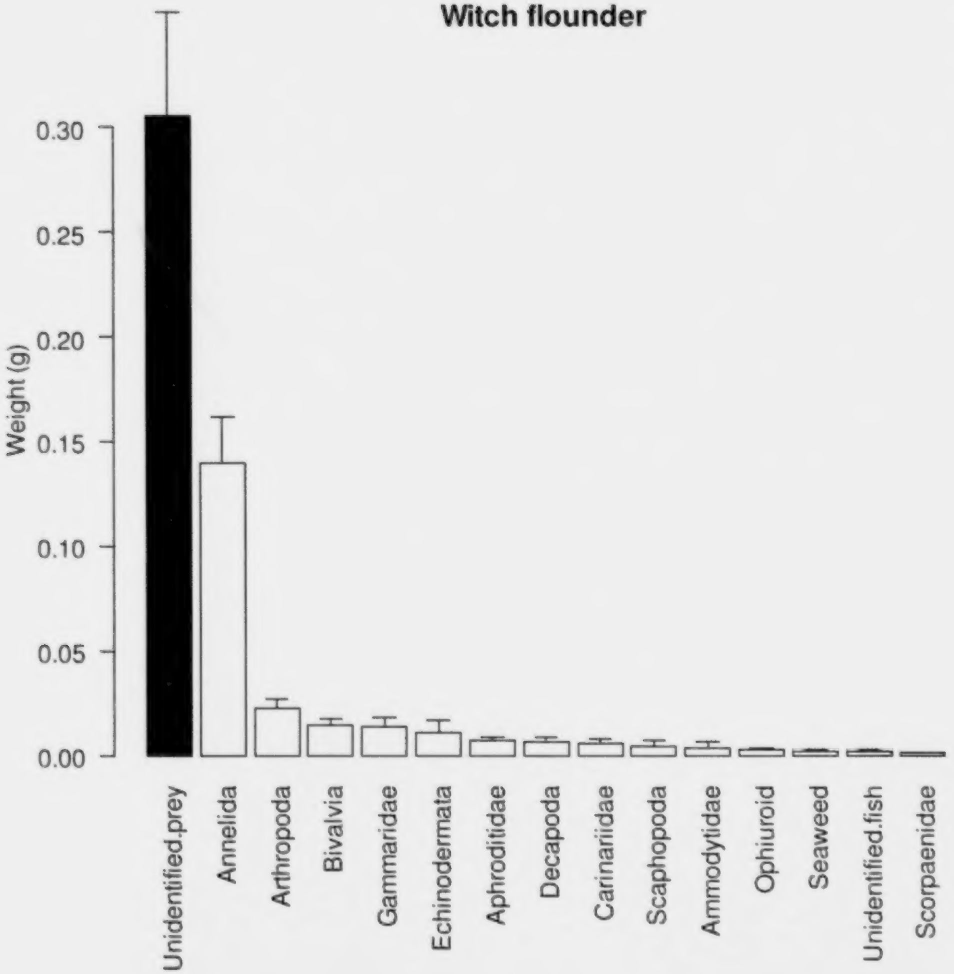

Figure 4.1.11- Mean (standard deviation) diet of witch flounder captured during RV surveys between 1995 and 2008. Green (grey) shading represent fin fish species, yellow (light grey) -invertebrates and plants and blue (black)-unidentified prey.

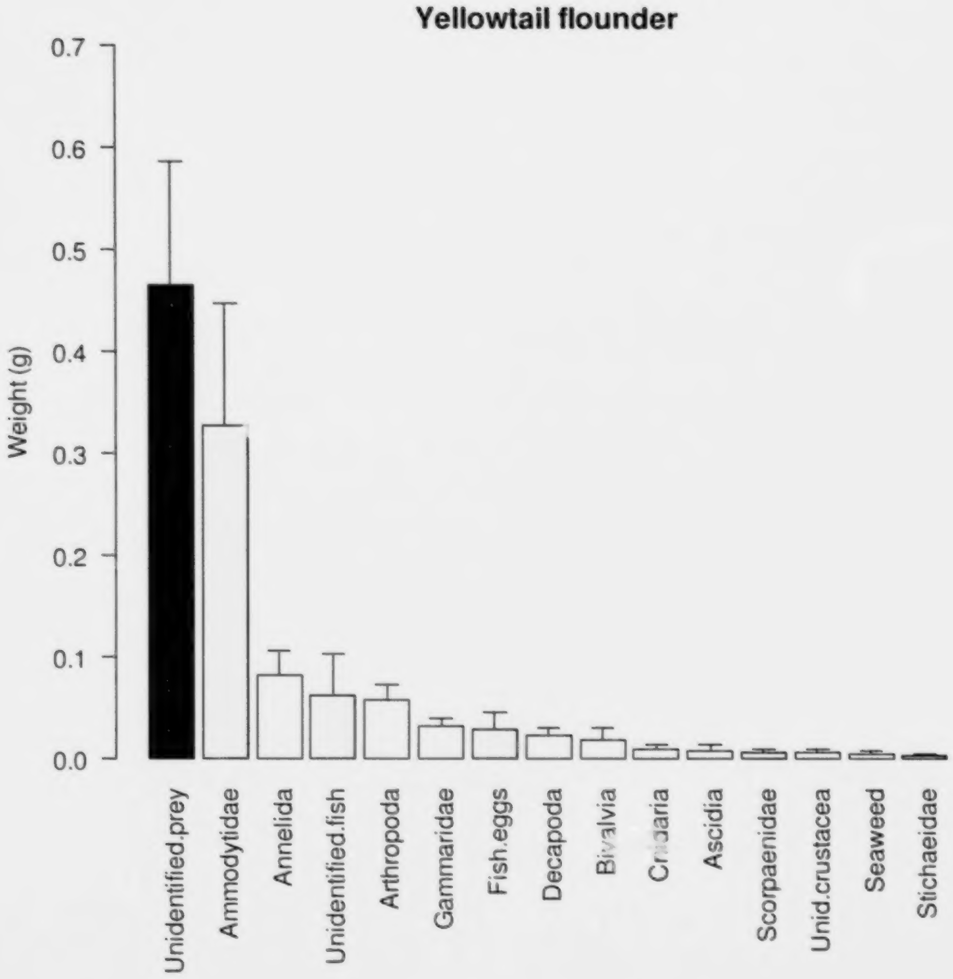

Figure 4.1.12- Mean (standard deviation) diet of yellowtail flounder captured during RV surveys between 1995 and 2008. Green (grey) shading represent fin fish species, yellow (light grey) invertebrates and plants and blue (black)- unidentified prey.

Table 4.1.1 Percent diet compostion for species analysed during summer groundfish surveys between 1995 and 2008 with asymptotic species accumulation curves.

Family group	Atlantic cod	Herring	Capelin	Mackerel	Sandlance	American Plaice	White hake	Silver hake	Thorny skate	Witch flounder	Yellowtail flounder	Haddock
Ammodytidae	15.41	.	.	.	0.01	24.17	0.16	7.93	18.74	0.69	28.5	3.44
Scorpaenidae	1.22	0.02	.	.	.	0.15	1.67	0.12	.	0.24	0.5	1.49
Pyuridae, Ascidiidae, Molgulidae	0.27	.	.	.	.	1.52	<0.01	0.01	0.09	0.01	0.66	1.15
Clupeidae	18.31	0.05	.	.	.	0.1	34.46	23.4	0.04	.	.	0.07
Merlucciidae	3.85	.	.	.	.	1.41	9.83	18.05	0.62	.	.	0.23
Osmeridae	2.6	.	<0.01	.	.	7.56	0.08	0.08	0.05	.	0.05	.
Gadidae	3.65	.	.	.	.	.	23.47	4.69	0.33	.	.	48.49
Scombridae, Scomberesocidae	0.03	.	.	0.11	<0.01	.	0.74	.	0.63	.	.	1.33
Macrouridae	0.11	0.03	.	.	.	0.01	0.27	.	.	.	.	.
Paralichthyidae, Pleuronectidae	2.18	.	.	.	.	0.01	1.59	.	19.48	.	.	<0.01
Zoarcidae	0.12	.	.	.	.	0.08	0.24	.	1.03	.	.	<0.01
Cottidae, Hemitripteridae	0.23	.	.	.	.	0.03	0.02	<0.01	.	.	.	<0.01
Myctophidae	<0.01	.	.	.	.	.	0.01	.	0.02	.	.	0.01
Fish_larvae	<0.01	<0.01	.	.	.	.	.	0.51	0.03	.	.	.
Rajidae	0.01	.	.	.	.	.	0.34	.	.	.	.	.
Anarhichadidae	0.01	.	.	.	.	.	.	.	.	.	.	<0.01
Nemichthyidae	.	.	.	.	.	.	0.04	.	.	.	.	.
Pholidae	.	.	.	.	.	.	.	0.01	.	.	.	.
Synaphobranchidae	.	.	.	.	.	.	0.2	.	.	.	.	.
Other fish	.	.	.	.	.	<0.01	.	.	.	.	.	.
Arthropoda	6.6	15.89	20.74	28.03	7.81	0.65	0.04	0.58	1.97	4.16	5.03	1.97
Decapoda	8.46	26.6	20.67	0.52	23.27	13.76	2.54	11.46	6.12	1.17	1.98	1.63
Euphausiidae	3.6	41.39	26.91	4.11	24.38	2.1	3.69	11.29	0.52	0.12	0.12	2.12
Gammaridae	0.05	0.16	5.34	.	0.32	0.16	0.03	0.01	2.61	2.52	2.71	0.63
Hyperiidae	7.11	1.48	0.05	.	4.98	0.51	0.02	0.77	0.19	0.15	0.01	4.37
Other invertebrates	6.26	0.17	7.2	1.23	<0.01	3.99	9.75	6.1	10.74	0.32	5.39	0.9
Unidentifed_ crustacea	0.08	0.15	0.87	<0.01	3.56	0.24	0.02	0.13	0.51	0.16	0.44	0.89
Annelia	0.09	.	1.08	0.57	<0.01	2.09	<0.01	0.01	2.51	25.52	7.16	2.46
Isopoda	0.02	0.01	0.5	<0.01	.	0.02	0.02	.	0.3	0.1	0.12	0.05
Copepoda	0.01	0.83	1.01	.	12.51	0.02	<0.01	0.01	0.05	.	<0.01	0.01
Mysidae	<0.01	0.24	.	.	1.09	0.05	0.01	0.14	0.02	<0.01	0.01	0.01

Family group	Atlantic cod	Herring	Capelin	Mackerel	Sandlance	American Plaice	White hake	Silver hake	Thorny skate	Witch flounder	Yellowtail flounder	Haddock
Bivalvia	0.08	.	.	0.24	.	0.56	<0.01	<0.01	0.16	2.69	1.55	0.52
Echinodermata	0.2	.	.	.	0.41	1.91	.	.	0.08	1.99	0.04	1.92
Mollusca	0.05	0.01	.	<0.01	.	0.05	.	.	0.03	0.05	0.07	0.21
Ommastrephidae	0.74	.	.	0.6	.	0.04	5.06	7.55	0.79	.	.	3.98
Pandalidae	3.12	<0.01	.	.	.	9.57	3.07	2.22	2.42	.	0.02	0.3
Aphroditidae	0.15	.	.	.	.	0.34	<0.01	.	0.51	1.26	0.24	0.06
Cephalopoda	0.17	.	.	3.08	.	.	0.08	0.13	0.26	.	.	0.12
Ophiuroid	0.06	.	.	.	.	2.86	<0.01	.	0.15	0.45	0.12	4.79
Oregoniidae	2.3	.	.	.	.	0.34	0.06	.	7.6	0.05	.	0.18
Scaphopoda	0.44	.	.	.	<0.01	0.07	.	<0.01	0.12	0.81	0.08	0.15
Cancridae	4.4	.	.	.	.	0.03	0.05	.	0.49	.	.	0.2
Caprellidae	<0.01	.	.	.	.	0.02	<0.01	.	0.02	0.01	0.03	0.06
Cnidaria	0.27	.	.	.	.	1.11	.	.	<0.01	0.01	0.78	0.05
Crangonidae	0.01	.	.	.	.	0.14	0.01	0.09	0.83	.	.	<0.01
Cumacea	<0.01	.	1.32	.	0.29	0.01	.	.	<0.01	.	0.03	0.03
Paguridae	0.85	.	.	.	.	0.45	0.02	.	0.25	.	.	0.17
Pectinariidae, Pectinidae	1.67	.	.	.	.	0.22	<0.01	.	<0.01	0.16	0.01	0.47
Stichaeidae	0.06	.	.	.	.	0.25	0.03	.	0.61	.	0.26	<0.01
Buccinidae	<0.01	.	.	.	.	0.01	.	.	.	0.08	0.04	0.05
Fish_eggs	0.03	0.9	.	.	0.6	.	.	.	<0.01	.	2.43	.
Thalassinidae	0.06	.	.	.	.	0.05	<0.01	.	0.31	.	.	0.18
Hippolytidae	0.01	.	.	.	.	.	.	0.01	0.02	.	.	<0.01
Maldanidae	<0.01	.	.	.	.	0.1	.	.	.	0.03	0.03	<0.01
Naticidae	0.23	.	.	.	.	0.01	.	.	.	.	.	0.01
Phyllophoridae, Phyllodocidae	<0.01	.	.	.	.	.	.	.	0.03	.	0.07	0.01
Strongylocentrotidae	<0.01	.	.	.	.	0.45	.	.	.	.	0.23	0.34
Arcidae	<0.01	.	.	.	.	0.01	.	.	.	.	<0.01	0.06
Asteroidea	<0.01	.	.	.	.	0.95	.	.	.	.	.	0.01
Axiidae	0.01	.	.	.	.	.	.	.	.	.	.	0.35
Ctenophora	<0.01	.	.	.	.	0.01	.	.	.	.	.	0.47
Galatheidae	<0.01	.	.	.	.	.	0.04	.	0.04	.	.	.
Gastropoda	<0.01	.	.	.	.	0.03	.	.	.	.	.	0.02
Lithodidae	0.08	.	.	.	.	.	0.27	.	.	.	.	.
Nephropidae	<0.01	.	.	.	.	.	0.24	.	.	.	.	0.02
Nereidae	<0.01	.	.	.	.	.	.	.	0.02	.	.	0.02
Pasiphaeidae	<0.01	.	.	.	.	.	<0.01	<0.01	0.34	.	.	0.01

Family group	Atlantic cod	Herring	Capelin	Mackerel	Sandlance	American Plaice	White hake	Silver hake	Thorny skate	Witch flounder	Yellowtail flounder	Haddock
Pharidae	<0.01	.	.	.	.	0.2	.	.	.	.	.	0.06
Cardiidae	.	.	.	.	.	.	.	.	.	.	.	0.06
Carinariidae	<0.01	.	.	.	.	.	.	.	.	1.02	.	.
Cylichnidae	.	.	.	.	.	.	.	.	.	.	0.22	<0.01
Glyceridae	.	.	.	.	.	<0.01	.	.	.	.	0.08	<0.01
Goniopectinidae	.	.	.	.	.	0.73	.	.	.	.	.	.
Mactridae	0.03	.	.	.	.	<0.01	.	.	.	.	.	<0.01
Majidae	<0.01	.	.	.	.	.	.	.	0.17	.	.	.
Polyplacophora	.	.	.	.	.	.	.	.	.	.	.	0.01
Priapulidae	.	.	.	.	.	.	.	.	0.01	.	.	.
Sepiolodae	<0.01	.	.	.	.	.	.	.	0.11	.	.	.
Sphaeromatidae	<0.01	.	.	.	.	.	0.04	.	.	.	.	<0.01
Tunicata	0.38	.	.	<0.01	.	.	<0.01	<0.01	<0.01	.	.	<0.01
Yoldiidae	.	.	.	.	.	.	.	.	.	.	.	0.03
Agonidae	<0.01	.	.	.	.	.	.	.	<0.01	.	.	.
Broyzoans	<0.01	.	.	.	.	<0.01	.	.	.	.	.	.
Echinasteridae, Echinarachniidae	.	.	.	.	.	.	.	.	.	.	.	<0.01
Invertebrate eggs	.	.	.	.	.	.	.	.	.	.	.	<0.01
Littorinidae	<0.01	.	.	.	.	.	<0.01	.	.	<0.01	.	<0.01
Nuculidae, Nuculanidae	<0.01	.	.	.	.	.	.	.	<0.01	.	.	<0.01
Pennatulidae	<0.01	.	.	.	.	.	.	.	.	.	.	<0.01
Porifera	<0.01	.	.	.	.	<0.01	.	<0.01	.	.	.	<0.01
Pycnogonia	.	.	.	.	.	.	<0.01	.	<0.01	.	.	<0.01
Other	4.22	12.07	14.32	61.48	20.76	19.9	1.77	4.67	17.9	55.71	40.58	13.7
Parasites	0.01	.	.	.	.	0.12	0.01	<0.01	0.13	0.11	0.02	0.02
Seaweed	0.08	.	.	0.02	.	0.82	<0.01	<0.01	0.01	0.4	0.4	0.08

5. Discussion

The Food Habits Database contains diet information for a large number of species across broad temporal and spatial scales from a number of sources. Species accumulation curves provide a good qualitative tool with which to assess the adequacy or completeness of food habits data (Link and Almedia 2000). The calculation of the minimum deterivative for each SAC allowed for a more quantitative interpretation of results. Most of the data sources provide sufficient information to describe the diet of at least one predator at a specific temporal and spatial scale when analysed at the family level.

A comparable analysis at a greater degree of taxonomic resolution (e.g, to the speciel level) would result in fewer species accumulation curves reaching the asymptote since the pool of potential prey items is larger. We recommend that when these diet data are used, the user first examine the data at the spatial, temporal and prey resolution scale at which the data will be used using a SAC as outlined here, to determine how well the data describe the diet of the species in question. In cases where an asymptote is not reached, we caution the user against using the data for anything other than exploratory purposes.

The data can be used for a wide variety of analyses, however, grouping the data across data sources should only be done with caution since they were collected using a variety of methods and the level of detail associated with the prey identification is not consistent. Moreover, broadly grouping data may mask some of the interesting spatial and temporal differences in the underlying fish diets.

The DFO RV Survey is the most consistent sampling platform in the database. However not all species are well represnted, there is better coverage in NAFO Division 4VW than 4X, and better coverage in Summer than Spring. Arguably, good seasonable representation of food habits is one of the main gaps in this database. Although there are no plans to add more seasonal RV Surveys, effort needs to be directed to increase the intensity of sampling from the Spring survey as there are still a significant proportion of species that do not have adequately described diets, particularly in recent years.

We estimated diets based on the weight of prey items, but other metrics are also commonly used in published work (Cortés 1997; Liao et al. 2001). Weight based analysis of food preference places the importance of heavier prey higher than those more abundant, lighter prey items. Other analyses calculate the frequency of occurrence of prey items or the proportion of total number of items consumed. There are trade offs in using the different measures of diet description. Including several methods of diet description for comparison may be the best way to quantify species food habits. However, for the current exercise we decided to limit our diet descriptions to survey-weighted mean weight of prey items.

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Appendix 1-Stomach sampling protocols

Stomach sampling protocol
RV Surveys
February, 2009

Background

Monitoring what fish eat provides information on the interactions between species (who eats what and how much), how the ecosystem is structured, the degree of connectedness and the main energy pathways. It can be used to estimate predation mortality, consumption estimates for individual species and as input into ecosystem models. As DFO moves towards an ecosystem approach to fisheries, we are working to include this information into our assessment of stock status and harvesting strategies.

Accurate representations of diet and consumption requires representative sampling across species' geographical range, life history stage and time, as diet can change spatially, temporally and with body size. Spatial changes in diet may result from availability of prey items, but may also be related to other oceanographic features such as temperature, depth or habitat type. As fish grow, their prey field changes, since their mouth size increases, they swim faster and their distribution may change. Temporal diet changes are observed at a range of time scales. On a daily basis many fish show diel feeding patterns, whereas seasonal and interannual changes in diet have also been observed.

Objective

Obtain food habits data for a set of specified species across sampled body sizes at all geographic locations.

Sampling design

We are combining the stratified random design of the RV survey with a length stratified sample of individual species within each set. This design allows us to obtain good estimates of diet and consumption across their geographic and body size range.

Sampling procedure

Fish Samplers- aka Cutters

For each fish species from each valid survey set.

1 Fish for stomachs are sampled either in 1 cm, 3 cm or 5cm length groups, 1 fish per length group (see Tables 1 and 2). All fish below 20cm are sampled in

1cm length groups. Use **Tally sheets** to keep track of length groups. Depending which species you are processing, the GSE may or may not prompt you for **weight- Make sure you enter this, even if not prompted.**

2 Once you have completed the regular sampling of the fish move to the **age mat** column. Depending which species you are processing, the GSE may or may not prompt you for an entry in the "age mat" column. For **otoliths,** you enter a "**1**" in this column if you are just collecting stomachs enter a "**9**". **You must enter a "9" in order to generate a fish number.** **Never type in a fish number.**

3 Check mouth/trachea for contents-
-if food is present then stomach is regurgitated (s6)
-if stomach is visible then it is everted (s5)
Enter appropriate code in remarks column of the GSE and you are done with this stomach.
-if mouth/trachea is clear then move on to **4**

4 Excise all stomachs not regurgitated (s6) or everted (s5) (unless fish are too small or are difficult to sample at sea, in which case the fish should be frozen whole, see 6))
-Excise apparently empty stomachs (s0) as diet remains are often identifiable.
-Remove only the stomach as other gut remains will contaminate the sample (ask for help if you are not sure where the stomach begins and ends).
-Fill out stomach label for all excised stomachs.
-See Appendix II for definitions of stomach fullness.

5 Determine whether the fish will be processed at sea (**go to 6**) or frozen **(go to 9)** as either a removed stomach or **swf**.

PROCEDURE FOR SAMPLES THAT WILL BE PROCESSED AT SEA.

6 For **all** fish sampled for stomachs, enter the stomach fullness in the REMARKS column of the GSE (see Appendix II), using a small "s", eg, s0, s1, s2…s4.

7 Stomach Removal: Excise the stomach, cutting at the oesophagus and the pyloric sphincter. Put the stomach in a plastic dish with the stomach label. Make sure that **stomach labels are written for all fish, even for fish which are frozen**.

8 If you think that the stomach is empty, excise it and place in plastic dish with label and let the stomach samplers examine it.

9 PROCEDURE FOR SAMPLES THAT WILL BE FROZEN

a) **If you are saving the whole fish** and the **mouth and trachea are clear**, record '**swf**' in the **Remarks** column of the GSE

b) If you are **removing the stomach** (see 7 above) and the **mouth and trachea are clear** record the stomach fullness '**s0, s1,...s4**' in the **Remarks** column of the GSE;

c) Fish that will be processed in the BIO lab should be frozen as soon as possible and placed in an individual plastic bag with the **completed** stomach label. If possible, remove the stomach **intact** (see **9** below); if it is not possible to remove the stomach **intact** (e.g., small specimens), the whole fish should be frozen.

- All fish/stomachs for freezing from a set should be placed together in a larger plastic bag labelled –with the MISSION And SET numbers. Place bags in tote box labelled STOMACHS. More than one set can, and should, be included in a labelled tote box.

Stomach Samplers

10 At sea, all data are directly entered into Microsoft access database (See below)

11 Weigh the total stomach, including mucus, to the nearest 0.1g, i.e., total stomach contents. **Do not include water in the stomach weight. Please** ensure that the balance (**including the weighing dish**) is **tared**.

12 Sort stomach contents out by prey species. Prey should be identified to the lowest taxon practical. **Species Identification Guides and Prey Species Codes are provided.** Use the magnifying lamp or dissecting microscope where necessary. Ask others on your watch if you are unsure about a species' identification.

Fish – should be identified to species to the extent possible (see species ID lists and codes for a list of species and codes of likely prey species). At more advanced stages of digestion, a coarser identification will be necessary.

Invertebrates – reasonable effort should be made to identify them to the lowest taxonomic level.

Parasites – should be separated, weighed and coded just like the other invertebrates.

Mucus (9100) should be weighed and coded separately

NOTE: Do not assume the taxonomy of prey items that are too digested to identify properly. For example, just because a stomach contains many identifiable individuals of a given shrimp species in addition to a well digested ball of shrimp mush does not mean that the latter is composed of the same species. Always code all prey items to the level at which a proper identification can be made – ie., ball of shrimp mush (2100).

SECOND NOTE: If the identity of a relatively fresh prey item is uncertain, freeze the prey item including a label with Mission, Set, Date, Species Code, Fish Number and a note indicating a prey to be identified in the lab. Make a note that the prey item was frozen for later ID in the *Remarks* column of the database.

THIRD NOTE: Please be very careful in the coding and naming of species. An error made at this stage is very difficult to fix afterwards. A species code list is provided in the database.

13 **All fish, crabs, shrimp**, lobster, octopus and squid should be processed individually** (i.e., separate data record for each individual prey item, up to 10 prey items). Other invertebrate taxa should be processed by pooling all individuals of the given taxon, and record the number of individuals.

**

a) at a minimum, try to discriminate *Pandalus borealis, P. montagui* and Pandalid shrimp from the other shrimp species

b) If possible identify and process individually the other shrimp species, i.e., Crangonid sp., Lebbeus sp., Eualus sp., Spirontocaris sp. *Pasiphaea multidentata* etc.

c) Krill/euphausids are not shrimp and need to be differentiated

14 Record the prey species code.

15 Estimate the prey state of digestion, on a scale from 1-4 (see table in Appendix II).

16 Obtain the weight of each prey item to the nearest 0.1g.
-Please ensure that the balance is tared each time.
-Do not throw away any prey items until the stomach has been completely processed.

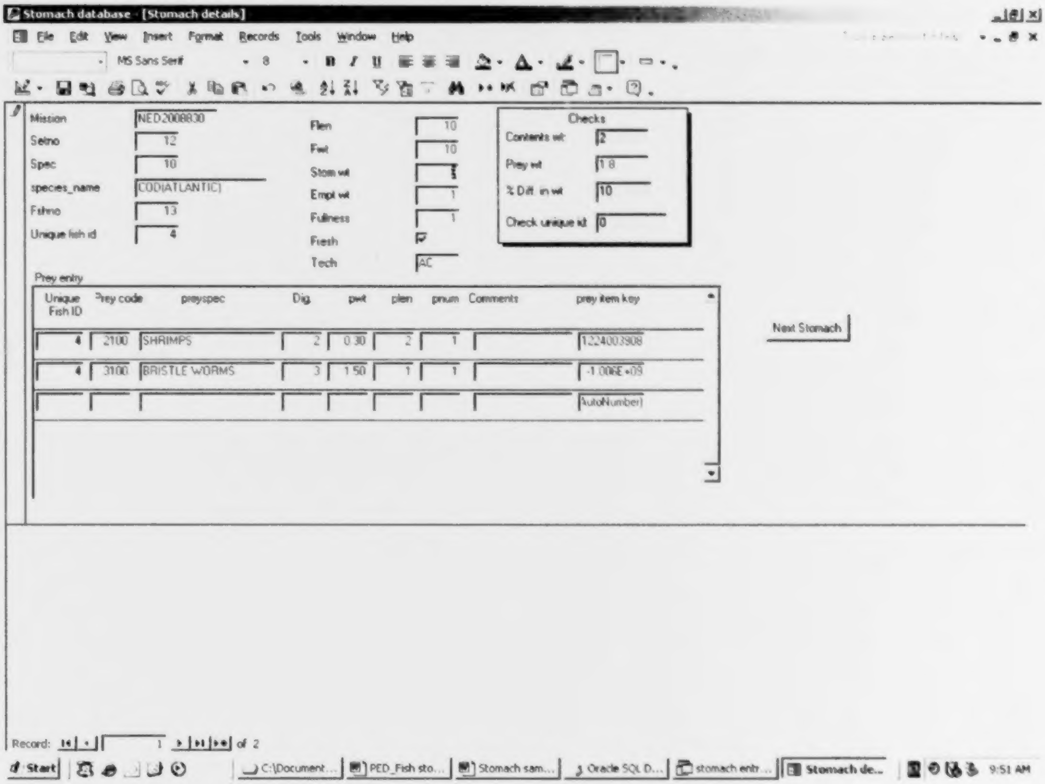
17 Individual fish, shrimp, crabs, and squid should be length measured, rounding up to the nearest mm for all. Use the callipers to measure the carapace width of crabs or the cephalothorax length of lobster or the **carapace length and**

total length of shrimp (record *cl* in length column and *tl* in the remarks). Use the non-offset herring measuring board and the standard survey measurement type to measure the other taxa (*fish*, fork length or total length; *squid*, mantle length; *octopus*, total length).

Subsampling: If the stomach contains more than 10 individuals of a given prey species, measure only the first 10 individuals. For the remainder of the individuals, obtain a bulk weight and enter on a new line of the database (along with the prey species code, and number of individuals).

Stomach Database Access Entry (Desktop Stomach entry1.mdb)

-Data entry occurs on a form called Stomach details.
-Each stomach entry will occur on a single page as seen below.


Stomach database - [Stomach details]
File
Edit
View
Insert
Format
Records
Tools
Window
Help
MS Sans Serif
8
Next Stomach
Start
C:\Document...
PED_Fish sto...
Stomach sam...
Oracle SQL D...
stomach entr...
Stomach de...
9:51 AM

Mission: NED2008830
Setno: 12
Spec: 10
species_name: COD(ATLANTIC)
Fshno: 13
Unique fish id: 4

Flen: 10
Fwt: 10
Stom wt: 3
Empt wt: 1
Fullness: 1
Fresh: ☑
Tech: AC

Checks
Contents wt: 2
Prey wt: 1.8
% Diff. in wt: 10
Check unique id: 0

Prey entry

Unique Fish ID	Prey code	preyspec	Dig.	pwt	plen	pnum	Comments	prey item key
4	2100	SHRIMPS	2	0.30	2	1		1224003908
4	3100	BRISTLE WORMS	3	1.50	1	1		-1.006E+09
								(AutoNumber)

Record: 1 of 2

Once all prey items have been entered check to ensure that the automatic entries in the CHECKS box are not RED!! If any are red an error has been made in data entry and should be checked before proceeding.

Once you are satisfied with data entry then Click on the "Next Stomach" button to move on to the next stomach.

Fields for Stomach Details Entry Form

Header information

Mission-
Setno
Spec- species code
Species_name- automatic field based on Spec
Fshno (GSE)- the number generated for the GSE
Unique fish id- automatically generated and used only in this database only
Flen- fish length
Fwt- fish weight (not required field)
Stom wt- the stomach weight when full
Empt wt- the empty stomach weight
Fullness- the stomach fullness code (0,1,2,3,4,5,6)
Fresh- if sample is done at sea then it is fresh
Tech- the stomach sampler (not the data entry person)

Prey item information

Unique fish id- automatically generated and same as in header
Prey code- prey item code from code book
Prey spec- automatically generated prey item code based on the prey code
Dig.- state of digestion of the prey item (1,2,3,4)
Pwt- prey item weight
Plen- prey length (mm)
Pnum- the number of individuals that constitute the prey item
Comments- write what you want but try and avoid symbols (!%&, etc)

Checks

Contents wt: Stom wt – Empt wt (if negative will be red)
Prey wt: Sum of the weight of the prey items
% Diff in wt: the percent difference between contents wt and prey wt (if greater than allowable percent then will be red)
Check unique id- makes sure that the unique id in the header field matches the unique id in all the prey items field (if they are not the same for all prey items this will turn red).

Description of Stomach entry1 Access database

Tables

Full dataset- all of the data after it is appended from the data entry tables

Full stomach entry- the header information from the stomach details form gets directly entered here (the primary key is Unique Fish id)

Look up prey name table- is the look up table for the species code form

Prey entry table- the prey item information on the stomach details form, is linked to the Full stomach entry table through the foreign key (Unique fish id) and has a primary key of Prey item id

Preyspec- is the lookup table for the prey names in the prey entry table

Species- is the lookup table for the species name in the full stomach entry table

Queries

Append data to full dataset- appends the data from *Full stomach entry* and *Prey entry table* to *Full dataset*

Empty stomachs entry- appends the data from the *Full stomach entry* that does not have prey items associated (s0).

Forms

Species lookup form- allows you to lookup prey items independent of the data entry form

Stomach details- is the main data entry form

Reports

Stomach entry by set- generates a word document of the *Full dataset* grouping information by set, spec and fish number

(Fish >=20cm: 1 predator per **Length Interval** per set)
(Fish < 20cm: 1 predator per 1 cm per set)

SPECIES	NAME	Length Interval
10	COD(ATLANTIC)	5
11	HADDOCK*	5
12	WHITE HAKE	5
13	SQUIRREL OR RED HAKE	5
14	SILVER HAKE	5
15	CUSK	ALL
16	POLLOCK	5
23	REDFISH UNSEPARATED	5
30	HALIBUT(ATLANTIC)	5
31	TURBOT,GREENLAND HALIBUT	5
40	AMERICAN PLAICE	5
41	WITCH FLOUNDER	5
42	YELLOWTAIL FLOUNDER	5
43	WINTER FLOUNDER	5
50	STRIPED ATLANTIC WOLFFISH	5
51	SPOTTED WOLFFISH	ALL
52	NORTHERN WOLFFISH	ALL
64	CAPELIN	3
112	LONGFIN HAKE	5
160	ARGENTINE(ATLANTIC)	5
201	THORNY SKATE	5
202	SMOOTH SKATE	5
204	WINTER SKATE	5
220	SPINY DOGFISH	5
300	LONGHORN SCULPIN	3
400	MONKFISH	5
320	SEA RAVEN	5
410	MARLIN SPIKE GRENADIER	5
501	LUMPFISH	5
603	WOLF EELPOUT	All
610	SAND LANCE (NORTHERN)	3
619	EELPOUT, NEWFOUNDLAND	5
622	SNAKE BLENNY	3
623	DAUBED SHANNY	3
640	OCEAN POUT (COMMON)	5
647	SHORTTAILED EELPOUT(VAHL)	5

Codes to be used to characterize the *Stomach Fullness*

Code	*Definition*	*Details*
s0	empty	no food contents
s1	less than ¼ full	based on visual assessment of contents with respect to estimated capacity
s2	¼ to ½ full	
s3	½ to ¾ full	
s4	¾ full to full	
s5	everted	stomach displaced into oesophagus and/or mouth
s6	regurgitated	stomach flabby and thin, may have food remains in mouth

Codes to be used to characterize the *State of Digestion*

Code	Definition: *Digestion*	Interpretation
1	Undigested /freshly eaten	No skin discoloration or fin deterioration of fish prey. Crustacean carapaces and echinoderm flesh are hard.
2	Slight	Prey easily recognizable. Fish skin is discoloured. Crustacean carapaces are intact but soft.
3	Intermediate	Prey barely recognizable to the species level, however individual prey are reasonably distinct
4	Advanced	Prey only recognizable at a coarse taxonomic level; mush

Appendix 2: Prey items and family groupings for species accumulation curves

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Acanthocephala	null	null	null	null	ACANTHOCEPHALA_P.	ACANTHOCEPHALA_P.	ANNELIDA	275
Annelida	Clitellata	null	null	null	OLIGOCHAETA_C.	AQUATIC_EARTHWORMS	ANNELIDA	37
Annelida	Polychaeta	Aciculata	Aphroditidae	Aphrodita	APHRODITA_HASTATA	SEA_MOUSE	APHROFAM	658
Annelida	Polychaeta	Aciculata	Aphroditidae	Aphrodita	APHRODITA_SP.	APHRODITA_SP.	APHROFAM	1
Annelida	Polychaeta	Aciculata	Aphroditidae	null	APHRODITIDAE_F.	APHRODITIDAE_F.	APHROFAM	88
Annelida	Polychaeta	Aciculata	Eunicidae	Eunice	EUNICE_PENNATA	EUNICE_PENNATA	EUNICFAM	19
Annelida	Polychaeta	Aciculata	Glyceridae	Glycera	GLYCERA_CAPITATA	BLOOD_WORM	GLYCEFAM	4
Annelida	Polychaeta	Aciculata	Glyceridae	Glycera	GLYCERA_SP.	BLOOD_WORMS	GLYCEFAM	439
Annelida	Polychaeta	Aciculata	Glyceridae	null	GLYCERIDAE_F.	GLYCERIDAE_F.	GLYCEFAM	4
Annelida	Polychaeta	Aciculata	Goniadidae	Goniada	GONIADA_MACULATA	GONIADA_MACULATA	GONIAFAM	33
Annelida	Polychaeta	Aciculata	Goniadidae	Goniada	GONIADA_NORVEGICA	GONIADA_NORVEGICA	GONIAFAM	1
Annelida	Polychaeta	Aciculata	Goniadidae	Goniada	GONIADA_SP.	CHEVRON_WORMS	GONIAFAM	333
Annelida	Polychaeta	Aciculata	Goniadidae	null	GONIADIDAE_F.	GONIADIDAE_F.	GONIAFAM	3
Annelida	Polychaeta	Aciculata	Hesionidae	null	HESIONIDAE_F.	HESIONIDAE_F.	HESIOFAM	1
Annelida	Polychaeta	Aciculata	Lumbrineridae	Lumbrineris	LUMBRINERIS_FRAGILIS	LUMBRINERIS_FRAGILIS	LUMBRFAM	2
Annelida	Polychaeta	Aciculata	Lumbrineridae	Lumbrineris	LUMBRINERIS_LATREILLI	LUMBRINERIS_LATREILLI	LUMBRFAM	5
Annelida	Polychaeta	Aciculata	Lumbrineridae	Lumbrineris	LUMBRINERIS_SP.	LUMBRINERIS_SP.	LUMBRFAM	2
Annelida	Polychaeta	Aciculata	Lumbrineridae	Lumbrineris	LUMBRINERIS_TENUIS	LUMBRINERIS_TENUIS	LUMBRFAM	2
Annelida	Polychaeta	Aciculata	Lumbrineridae	Ninoe	NINOE_NIGRIPES	NINOE_NIGRIPES	LUMBRFAM	6
Annelida	Polychaeta	Aciculata	Lumbrineridae	null	LUMBRINEREIDAE_F.	LUMBRINEREIDAE_F.	LUMBRFAM	377
Annelida	Polychaeta	Aciculata	Nephtyidae	Aglaophamus	AGLAOPHAMUS_CIRCINATA	AGLAOPHAMUS_CIRCINATA	NEPHTFAM	6
Annelida	Polychaeta	Aciculata	Nephtyidae	Nephtys	NEPHTYS_BUCERA	NEPHTYS_BUCERA	NEPHTFAM	1
Annelida	Polychaeta	Aciculata	Nephtyidae	Nephtys	NEPHTYS_INCISA	NEPHTYS_INCISA	NEPHTFAM	2
Annelida	Polychaeta	Aciculata	Nephtyidae	Nephtys	NEPHTYS_SP.	NEPHTYS_SP.	NEPHTFAM	497
Annelida	Polychaeta	Aciculata	Nephtyidae	null	NEPHTYIDAE_F.	NEPHTYIDFAE_F.	NEPHTFAM	61
Annelida	Polychaeta	Aciculata	Nereidae	Nereis	NEREIS_GRAYI	NEREIS_GRAYI	NEREIFAM	2
Annelida	Polychaeta	Aciculata	Nereidae	Nereis	NEREIS_PELAGICA	NEREIS_PELAGICA	NEREIFAM	11
Annelida	Polychaeta	Aciculata	Nereidae	Nereis	NEREIS_SP.	NEREIS_SP.	NEREIFAM	81
Annelida	Polychaeta	Aciculata	Nereidae	Nereis	NEREIS_ZONATA	NEREIS_ZONATA	NEREIFAM	1
Annelida	Polychaeta	Aciculata	Nereidae	null	NEREIDAE_F.	NEREIDAE_F.	NEREIFAM	3
Annelida	Polychaeta	Aciculata	Oenonidae	Arabella	ARABELLA_IRICOLOR	OPAL_WORM	OENONFAM	6
Annelida	Polychaeta	Aciculata	Oenonidae	Drilonereis	DRILONEREIS_MAGNA	ARABELLID_THREAD_WORM	OENOFAM	1
Annelida	Polychaeta	Aciculata	Onuphidae	Nothria	NOTHRIA_CONCHYLEGA	NOTHRIA_CONCHYLEGA	ONUPHFAM	767
Annelida	Polychaeta	Aciculata	Onuphidae	null	ONUPHIDAE_F.	ONUPHIDAE_F.	ONUPHFAM	1
Annelida	Polychaeta	Aciculata	Phyllodocidae	Eteone	ETEONE_SP.	PADDLE_WORMS	PHYLLFAM	279
Annelida	Polychaeta	Aciculata	Phyllodocidae	Phyllodoce	PHYLLODOCE_GROENLANDICA	P_GROENLANDICA	PHYLLFAM	24
Annelida	Polychaeta	Aciculata	Phyllodocidae	Phyllodoce	PHYLLODOCE_SP.	PHYLLODOCE_SP.	PHYLLFAM	13
Annelida	Polychaeta	Aciculata	Phyllodocidae	null	PHYLLODOCIDAE_F.	PHYLLODOCIDAE_F.	PHYLLFAM	280
Annelida	Polychaeta	Aciculata	Polynoidae	Gattyana	GATTYANA_SP.	GATTYANA_SP.	POLYNFAM	1
Annelida	Polychaeta	Aciculata	Polynoidae	Lepidonotus	LEPIDONOTUS_SQUAMATUS	LEPIDONOTUS_SQUAMATUS	POLYNFAM	10
Annelida	Polychaeta	Aciculata	Polynoidae	null	POLYNOIDAE_F.	POLYNOIDAE_F.	POLYNFAM	128
Annelida	Polychaeta	Aciculata	Syllidae	Exogone	EXOGONE_SP.	EXOGONE_SP.	SYLLIFAM	2
Annelida	Polychaeta	Aciculata	Syllidae	Exogone	EXOGONE_VERUGERA	EXOGONE_VERUGERA	SYLLIFAM	1
Annelida	Polychaeta	Aciculata	Syllidae	null	SYLLIDAE_F.	SYLLIDAE_F.	SYLLIFAM	1
Annelida	Polychaeta	Canalipalpata	Ampharetidae	Ampharete	AMPHARETE_FINMARCHICA	AMPHARETE_FINMARCHICA	AMPHAFAM	1
Annelida	Polychaeta	Canalipalpata	Ampharetidae	Ampharete	AMPHARETE_SP.	AMPHARETE_SP.	AMPHAFAM	9
Annelida	Polychaeta	Canalipalpata	Ampharetidae	Amphitrite	AMPHITRITE_SP.	TEREBELLID_WORM	AMPHAFAM	218
Annelida	Polychaeta	Canalipalpata	Ampharetidae	Anobothrus	ANOBOTHRUS_GRACILIS	ANOBOTHRUS_GRACILIS	AMPHAFAM	3
Annelida	Polychaeta	Canalipalpata	Ampharetidae	Melinna	MELINNA_CRISTATA	AMPHARETID_WORM	AMPHAFAM	581
Annelida	Polychaeta	Canalipalpata	Ampharetidae	Melinna	MELINNIA_ELIZABETHAE	MELINNIA_ELIZABETHAE	AMPHAFAM	1

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Annelida	Polychaeta	Canalipalpata	Ampharetidae	Samytha	SAMYTHA_SEXCIRRATA	SAMYTHA_SEXCIRRATA	AMPHAFAM	2
Annelida	Polychaeta	Canalipalpata	Ampharetidae	null	AMPHARETIDAE_F.	AMPHARETIDAE_F.	AMPHAFAM	6
Annelida	Polychaeta	Canalipalpata	Apistobranchidae	null	APISTOBRANCHIDAE_F.	APISTOBRANCHIDAE_F.	APISTFAM	1
Annelida	Polychaeta	Canalipalpata	Cirratulidae	null	CIRRATULIDAE_F.	CIRRATULIDAE_F.	CIRRAFAM	3
Annelida	Polychaeta	Canalipalpata	Flabelligerida	Brada	BRADA_SP.	FLABELLIGERID_WORMS	FLABEFAM	128
Annelida	Polychaeta	Canalipalpata	Flabelligerida	Diplocirrus	DIPLOCIRRUS_HIRSUTUS	FLABELLIGERID_WORM	FLABEFAM	9
Annelida	Polychaeta	Canalipalpata	Flabelligerida	Pherusa	PHERUSA_PHERUSA	FLABELLIGERID_WORM	FLABEFAM	1
Annelida	Polychaeta	Canalipalpata	Flabelligerida	Pherusa	PHERUSA_SP.	FLABELLIGERID_WORMS	FLABEFAM	3
Annelida	Polychaeta	Canalipalpata	Flabelligerida	null	FLABELLIGERIDA_F.	FLABELLIGERIDA_F.	FLABEFAM	116
Annelida	Polychaeta	Canalipalpata	Maldanidae	Praxillella	PRAXILLELLA_SP.	PRAXILLELLA_SP.	MALDAFAM	1
Annelida	Polychaeta	Canalipalpata	Maldanidae	null	MALDANIDAE_F.	FILAMENT_TUBE_WORM	MALDAFAM	557
Annelida	Polychaeta	Canalipalpata	Maldanidae	null	RHODINE_SP.	RHODINE_SP.	MALDAFAM	3
Annelida	Polychaeta	Canalipalpata	Opheliidae	Ophelia	OPHELIA_ACUMINUTA	OPHELIA_ACUMINUTA	OPHELFAM	6
Annelida	Polychaeta	Canalipalpata	Opheliidae	Ophelia	OPHELIA_LIMACINA	OPHELIA_LIMANCIA	OPHELFAM	97
Annelida	Polychaeta	Canalipalpata	Opheliidae	Ophelia	OPHELIA_SP.	OPHELIA_SP.	OPHELFAM	2
Annelida	Polychaeta	Canalipalpata	Opheliidae	Travisia	TRAVISIA_CARNEA	TRAVISIA_CARNEA	OPHELFAM	1
Annelida	Polychaeta	Canalipalpata	Opheliidae	null	OPHELIIDAE	OPHELIIDAE_F.	OPHELFAM	236
Annelida	Polychaeta	Canalipalpata	Orbiniidae	Scoloplos	SCOLOPLOS_SP.	ORBINIID_WORMS	ORBINFAM	9
Annelida	Polychaeta	Canalipalpata	Orbiniidae	null	ORBINIIDAE_F.	ORBINIIDAE_F.	ORBINFAM	2
Annelida	Polychaeta	Canalipalpata	Oweniidae	Owenia	OWENIA_FUSIFORMIS	OWENIA_FUSIFORMIS	OWENIFAM	11
Annelida	Polychaeta	Canalipalpata	Oweniidae	null	OWENIIDAE_F.	OWENIIDAE_F.	OWENIFAM	9
Annelida	Polychaeta	Canalipalpata	Paraonidae	Aricidea	ARICIDEA_SP.	ARICIDEA_SP.	PARAOFAM	3
Annelida	Polychaeta	Canalipalpata	Paraonidae	Paraonis	PARAONIS_LYRA	PARAONIS_LYRA	PARAOFAM	2
Annelida	Polychaeta	Canalipalpata	Pectinariidae	Pectinaria	PECTINARIA_GOULDII	TRUMPET_WORM	PECTIFAM	88
Annelida	Polychaeta	Canalipalpata	Pectinariidae	Pectinaria	PECTINARIA_GRANULATA	PECTINARIA_GRANULATA	PECTIFAM	287
Annelida	Polychaeta	Canalipalpata	Pectinariidae	Pectinaria	PECTINARIA_SP.	PECTINARIA_SP.	PECTIFAM	18
Annelida	Polychaeta	Canalipalpata	Pectinariidae	null	PECTINARIIDAE_F.	PECTINARIIDAE_F.	PECTIFAM	5
Annelida	Polychaeta	Canalipalpata	Sabellidae	Chone	CHONE_DUNERI	CHONE_DUNERI	SABELFAM	1
Annelida	Polychaeta	Canalipalpata	Sabellidae	Chone	CHONE_SP.	CHONE_SP.	SABELFAM	2
Annelida	Polychaeta	Canalipalpata	Sabellidae	Euchone	EUCHONE_SP.	EUCHONE_SP.	SABELFAM	4
Annelida	Polychaeta	Canalipalpata	Sabellidae	Potamilla	POTAMILLA_NEGLECTA	FAN_WORM	SABELFAM	229
Annelida	Polychaeta	Canalipalpata	Sabellidae	Potamilla	POTAMILLA_RENIFORMIS	POTAMILLA_RENIFORMIS	SABELFAM	3
Annelida	Polychaeta	Canalipalpata	Sabellidae	null	SABELLIDAE_F.	SABELLIDAE_F.	SABELFAM	63
Annelida	Polychaeta	Canalipalpata	Scalibregmatidae	Scalibregma	SCALIBREGMA_INFLATUM	SCALIBREGMA_INFLATUM	SCALIFAM	9
Annelida	Polychaeta	Canalipalpata	Serpulidae	Spirorbis	SPIRORBIS_SP.	SPIRORBIS_SP.	SERFAM	1
Annelida	Polychaeta	Canalipalpata	Spionidae	null	SPIONIDA_F.	SPIONIDA_F.	SPIONFAM	38
Annelida	Polychaeta	Canalipalpata	Sternapsidae	Sternaspis	STERNASPIS_SCUTATA	STERNASPIS_SCUTATA	STERNFAM	121
Annelida	Polychaeta	Canalipalpata	Sternapsidae	Sternaspis	STERNASPIS_SP.	STERNASPIS_SP.	STERNFAM	51
Annelida	Polychaeta	Canalipalpata	Terebellidae	Thelepus	THELEPUS_CINCINNATUS	THELEPUS_CINCINNATUS	TEREBFAM	1
Annelida	Polychaeta	Canalipalpata	Terebellidae	null	TEREBELLIDAE_F.	TEREBELLIDAE_F.	TEREBFAM	78
Annelida	Polychaeta	Canalipalpata	Trichobranchidae	Terebellides	TEREBELLIDES_STROEMI	TEREBELLIDES_STROEMI	TRICHFAM	1
Annelida	Polychaeta	Capitellida	Capitellidae	null	CAPITELLIDAE_F.	CAPITELLIDAE_F.	CAPITFAM	2
Annelida	Polychaeta	Eunicida	Eunicidae	null	EUNICIDAE_F.	EUNICIDAE_F.	EUNICFAM	1
Annelida	Polychaeta	null	null	null	POLYCHAETA_C.	BRISTLE_WORMS	ANNELIDA	10466
Annelida	Polychaeta	null	null	null	POLYCHAETA_C._LARGE	LARGE_POLYCH__3MMDIA	ANNELIDA	359
Annelida	Polychaeta	null	null	null	POLYCHAETA_C._SMALL	SMALL_POLYCH3MM_DIA	ANNELIDA	256
Annelida	Polychaeta	null	null	null	POLYCHAETA_LARVAE	POLYCHAETA_LARVAE	ANNELIDA	2
Annelida	Polychaeta	null	null	null	POLYCHAETE_REMAINS	WORM_CAST	ANNELIDA	32
Annelida	null	null	null	null	ANNELIDA_P.	SEGMENTED_WORMS	ANNELIDA	3751
Annelida	null	null	null	null	ANNELID_EGGS	ANNELID_EGGS_UNID	INVEGGS	1

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca	AMPELISCA_AGASSIZI	FOUR-EYED_AMPHIPOD	AMPEFAM	3
Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca	AMPELISCA_SP.	AMPELISCA_SP.	AMPEFAM	13
Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	null	AMPELISCIDAE_F.	AMPELISCIDAE_F.	AMPEFAM	405
Arthropoda	Malacostraca	Amphipoda	Amphithoidae	null	AMPHITHOIDAE_F.	AMPHITHOIDAE_F.	AMPHFAM	2
Arthropoda	Malacostraca	Amphipoda	Aoridae	Leptocherirus	LEPTOCHEIRUS_PINGUIS	PURPLE_AMPHI	AORIFAM	387
Arthropoda	Malacostraca	Amphipoda	Aoridae	Uniciola	UNCIOLA_INERMIS	UNCIOLA_INERMIS	AORIFAM	1
Arthropoda	Malacostraca	Amphipoda	Aoridae	Uniciola	UNCIOLA_IRRORATA	UNCIOLA_IRRORATA	AORIFAM	8
Arthropoda	Malacostraca	Amphipoda	Aoridae	Uniciola	UNCIOLA_SP.	RED_AMPHI	AORIFAM	1097
Arthropoda	Malacostraca	Amphipoda	Aoridae	null	AORIDAE_F.	AORIDAE_F.	AORIFAM	20
Arthropoda	Malacostraca	Amphipoda	Caprellidae	Aeginina	AEGININA_LONGICORNIS	AEGININA__LONGICORNIS	CAPREFAM	8
Arthropoda	Malacostraca	Amphipoda	Caprellidae	Caprella	CAPRELLA_LINEARIS	CAPRELLA_LINEARIS	CAPREFAM	3
Arthropoda	Malacostraca	Amphipoda	Caprellidae	Caprella	CAPRELLA_SP.	CAPRELLA_SP.	CAPREFAM	2
Arthropoda	Malacostraca	Amphipoda	Caprellidae	null	CAPRELLIDAE_F.	CAPRELLIDAE_F.	CAPREFAM	1080
Arthropoda	Malacostraca	Amphipoda	Corophiidae	null	COROPHIIDAE_F.	COROPHIIDAE_F.	COROFAM	1
Arthropoda	Malacostraca	Amphipoda	Eusiridae	Rachotropis	RHACHOTROPIS_ACULEATA	RHACHOTROPIS_ACULEATA	EUSIFAM	3
Arthropoda	Malacostraca	Amphipoda	Eusiridae	Rachotropis	RHACHOTROPIS_SP.	RHACHOTROPIS_SP.	EUSIFAM	16
Arthropoda	Malacostraca	Amphipoda	Gammaridae	null	GAMMARIDAE_F.	GAMMARIDAE_F.	GAMMFAM	1461
Arthropoda	Malacostraca	Amphipoda	Gammaridae	null	GAMMARIDEA_S.O.	WHITE_G._AMPHI	GAMMFAM	70
Arthropoda	Malacostraca	Amphipoda	Gammaridae	null	GAMMARUS_SP.	GAMMARUS_SP.	GAMMFAM	115
Arthropoda	Malacostraca	Amphipoda	Haustoriidae	null	HAUSTORIIDAE	HAUSTORIIDAE	HAUSFAM	38
Arthropoda	Malacostraca	Amphipoda	Hyperiidae	Hyperia	HYPERIA_GALBA	BIG-EYED_AMPHIPOD	HYPERFAM	6
Arthropoda	Malacostraca	Amphipoda	Hyperiidae	Hyperia	HYPERIA_SP.	HYPERIA_SP.	HYPERFAM	185
Arthropoda	Malacostraca	Amphipoda	Hyperiidae	Parathemisto	PARATHEMISTO_COMPRESSA	PARATHEMISTO_COMPRESSA	HYPERFAM	7
Arthropoda	Malacostraca	Amphipoda	Hyperiidae	Parathemisto	PARATHEMISTO_GAUDICHAUDI	P_GAUDICHAUDI	HYPERFAM	64
Arthropoda	Malacostraca	Amphipoda	Hyperiidae	Parathemisto	PARATHEMISTO_OBLIVIA	PARATHEMISTO_OBLIVIA	HYPERFAM	11
Arthropoda	Malacostraca	Amphipoda	Hyperiidae	Parathemisto	PARATHEMISTO_SP.	PARATHEMISTO_SP.	HYPERFAM	217
Arthropoda	Malacostraca	Amphipoda	Hyperiidae	null	HYPERIIDAE_F.	HYPERIIDAE_F.	HYPERFAM	1498
Arthropoda	Malacostraca	Amphipoda	Ichneumonoidea	Haliragoides	HALIRAGOIDES_INERMIS	HALIRAGOIDES_INERMIS	ICHNEFAM	2
Arthropoda	Malacostraca	Amphipoda	Isaeidae	Gammaropsis	GAMMAROPSIS_MACULATUS	GAMMAROPSIS_MACULATUS	ISAEFAM	1
Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius	ERICTHONIUS_RUBRICORNIS	ERICTHONIUS_RUBRICORNIS	ISCHFAM	3
Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	null	ISCHYROCERIDAE_F.	ISCHYROCERIDAE_F.	ISCHFAM	1
Arthropoda	Malacostraca	Amphipoda	Lilljeborgia	Lilljeborgia	LILLJEBORGIA_SP.	LILLJEBORGIA_SP.	LILLFAM	1
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Hippomedon	HIPPOMEDON_PROPINQUUS	HIPPOMEDON_PROPINQUUS	LYSIFAM	4
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Hippomedon	HIPPOMEDON_SERRATUS	HIPPOMEDON_SERRATUS	LYSIFAM	2
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Hippomedon	HIPPOMEDON_SP.	HIPPOMEDON_SP.	LYSIFAM	6
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Phoxocephalus	PHOXOCEPHALUS_HOLBOLLI	PHOXOCEPHALUS_HOLBOLLI	LYSIFAM	1
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Phoxocephalus	PHOXOCEPHALUS_SP.	PHOXOCEPHALUS_SP.	LYSIFAM	1
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	null	LYSIANASSIDAE_F.	LYSIANASSIDAE_F.	LYSIFAM	293
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	null	ORCHOMONELLA_SP.	ORCHOMONELLA_SP.	LYSIFAM	2
Arthropoda	Malacostraca	Amphipoda	Melitidae	Ceradocus	CERADOCUS_TORELLI	CERADOCUS_TORELLI	MELIFAM	3
Arthropoda	Malacostraca	Amphipoda	Melitidae	Melita	MELITA_DENTATA	MELITA_DENTATA	MELIFAM	141
Arthropoda	Malacostraca	Amphipoda	Melitidae	Melita	MELITA_SP.	MELITA_SP.	MELIFAM	1
Arthropoda	Malacostraca	Amphipoda	Melphidippidae	Casco	CASCO_BIGELOWI	CASCO_BIGELOWI	MELPFAM	4
Arthropoda	Malacostraca	Amphipoda	Oedicerotidae	Monoculodes	MONOCULODES_LATIMANUS	MONOCULODES_ELATIMANUS	OEDIFAM	12
Arthropoda	Malacostraca	Amphipoda	Oedicerotidae	Monoculodes	MONOCULODES_SP.	MONOCULODES_SP.	OEDIFAM	162
Arthropoda	Malacostraca	Amphipoda	Oedicerotidae	Paroediceros	PAROEDICEROS_SP.	PAROEDICEROS_SP.	OEDIFAM	1
Arthropoda	Malacostraca	Amphipoda	Oedicerotidae	null	OEDICEROTIDAE_F.	OEDICEROTIDAE_F.	OEDIFAM	4
Arthropoda	Malacostraca	Amphipoda	Pardaliscidae	null	PARDALISCIDAE_F.	PARDALISCIDAE_F.	PARDFAM	1
Arthropoda	Malacostraca	Amphipoda	Phoxocephalidae	Harpinia	HARPINIA_CRENULATA	HARPINIA_CRENULATA	PHOXOFAM	1
Arthropoda	Malacostraca	Amphipoda	Phoxocephalidae	Harpinia	HARPINIA_PROPINQUA	HARPINIA_PROPINQUA	PHOXOFAM	7

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Arthropoda	Malacostraca	Amphipoda	Phoxocephalidae	Harpinia	HARPINIA_SP.	HARPINIA_SP.	PHOXOFAM	1
Arthropoda	Malacostraca	Amphipoda	Phronimidae	Phronima	PHRONIMA_SP.	PHRONIMA_SP.	PHRONFAM	1
Arthropoda	Malacostraca	Amphipoda	Pleustidae	Pleustes	PLEUSTES_PANOPLA	PLEUSTES_PANOPLA	PLEUSFAM	15
Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dulichia	DULICHIA_MONACANTHA	DULICHIA_MONACANTHA	PODOFAM	3
Arthropoda	Malacostraca	Amphipoda	Podoceridae	Dulichia	DULICHIA_SP.	DULICHIA_SP.	PODOFAM	1
Arthropoda	Malacostraca	Amphipoda	Pontoporeiidae	Priscillina	PRISCILLINA_ARMATA	PRISCILLINA_ARMATA	PONTOFAM	2
Arthropoda	Malacostraca	Amphipoda	Stenothoidae	Stenothoe	STENOTHOE_BREVICORNIS	STENOTHOE_BREVICORNIS	STENFAM	1
Arthropoda	Malacostraca	Amphipoda	Synopiidae	Tiron	TIRON_SP.	TIRON_SP.	SYNOFAM	6
Arthropoda	Malacostraca	Amphipoda	Tironidae	null	TIRONIDAE_F.	TIRONIDAE_F.	TIRONFAM	1
Arthropoda	Malacostraca	Amphipoda	Uristidae	Anonyx	ANONYX_SARSI	ANONYX_SARSI	URISFAM	1
Arthropoda	Malacostraca	Amphipoda	Uristidae	Anonyx	ANONYX_SP.	ANONYX_SP.	URISFAM	235
Arthropoda	Malacostraca	Amphipoda	Uristidae	Tmetonyx	TMETONYX_CICADA	TMETONYX_CICADA	URISFAM	8
Arthropoda	Malacostraca	Amphipoda	Uristidae	null	TMETONYX_SP.	TMETONYX_SP.	URISFAM	2
Arthropoda	Malacostraca	Amphipoda	null	null	AMPHIPODA_O.	AMPHIPODA_O.	ARTHRO	13530
Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis	DIASTYLIS_QUADRISPINOSA	DIASTYLIS_QUADRISPINOSA	DIASTFAM	1
Arthropoda	Malacostraca	Cumacea	Diastylidae	Diastylis	DIASTYLIS_SP.	DIASTYLIS_SP.	DIASTFAM	3
Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella	EUDORELLA_PUSILLA	EUDORELLA_PUSILLA	LEUCFAM	1
Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella	EUDORELLA_SP.	EUDORELLA_SP.	LEUCFAM	1
Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella	EUDORELLA_TRUNCATULA	EUDORELLA_TRUNCATULA	LEUCFAM	1
Arthropoda	Malacostraca	Cumacea	Nannastacidae	Campylaspis	CAMPYLASPIS_SP.	CAMPYLASPIS_SP	NANNFAM	1
Arthropoda	Malacostraca	Cumacea	null	null	CUMACEA_O.	CUMACEA_O.	CUMACEA	661
Arthropoda	Malacostraca	Decapoda	Anomura	null	CRAB(ANOMURA)	CRAB(ANOMURA)	ANOFAM	10
Arthropoda	Malacostraca	Decapoda	Axiidae	Axius	AXIUS_SERRATUS	AXIUS_SERRATUS	AXIIFAM	165
Arthropoda	Malacostraca	Decapoda	Axiidae	null	AXIIDAE_F.	AXIIDAE_F.	AXIIFAM	193
Arthropoda	Malacostraca	Decapoda	CALAPPIDAE_	null	CALAPPIDAE_F.	CALAPPIDAE_F.	CALAFAM	1
Arthropoda	Malacostraca	Decapoda	Calappidae	Calappa	CALAPPA_MEGALOPS	CALAPPA_MEGALOPS	CALAFAM	1
Arthropoda	Malacostraca	Decapoda	Cancridae	Cancer	CANCER_BOREALIS	JONAH_CRAB	CANCFAM	102
Arthropoda	Malacostraca	Decapoda	Cancridae	Cancer	CANCER_IRRORATUS	ATLANTIC_ROCK_CRAB	CANCFAM	67
Arthropoda	Malacostraca	Decapoda	Cancridae	Cancer	CANCER_SP.	CANCER_SP.	CANCFAM	800
Arthropoda	Malacostraca	Decapoda	Cancridae	null	CANCRIDAE_F.	CANCER_CRAB_(NS)	CANCFAM	40
Arthropoda	Malacostraca	Decapoda	Crangonidae	Argis	ARGIS_DENTATA	ARGIS_DENTATA	CRANFAM	22
Arthropoda	Malacostraca	Decapoda	Crangonidae	Crangon	CRANGON_SEPTEMSPINOSA	CRANGON_SEPTEMSPINOSA	CRANFAM	39
Arthropoda	Malacostraca	Decapoda	Crangonidae	Crangon	CRANGON_SP.	CRANGON_SP.	CRANFAM	320
Arthropoda	Malacostraca	Decapoda	Crangonidae	Pontophilus	PONTOPHILUS_BREVIROSTRIS	PONTOPHILUS_BREVIROSTRIS	CRANFAM	2
Arthropoda	Malacostraca	Decapoda	Crangonidae	Pontophilus	PONTOPHILUS_NORVEGICUS	PONTOPHILUS_NORVEGICUS	CRANFAM	1
Arthropoda	Malacostraca	Decapoda	Crangonidae	Sabinea	SABINEA_SEPTEMCARINATA	SABINEA_SEPTEMCARINATA	CRANFAM	3
Arthropoda	Malacostraca	Decapoda	Crangonidae	Sabinea	SABINEA_SP.	SABINEA_SP.	CRANFAM	20
Arthropoda	Malacostraca	Decapoda	Crangonidae	Sclerograngon	SCLEROCRANGON_SP.	SCLEROCRANGON_SP.	CRANFAM	41
Arthropoda	Malacostraca	Decapoda	Crangonidae	null	CRANGONIDAE_F.	CRANGONIDAE___F.	CRANFAM	362
Arthropoda	Malacostraca	Decapoda	Crangonidae	null	SNAPPING_SHRIMP_(OBSOLETE)	SNAPPING_SHRIMP	CRANFAM	8
Arthropoda	Malacostraca	Decapoda	Galatheidae	Munida	MUNIDA_IRIS	MUNIDA_IRIS	GALAFAM	35
Arthropoda	Malacostraca	Decapoda	Galatheidae	Munida	MUNIDA_VALIDA	MUNIDA_VALIDA	GALAFAM	1
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Caridion	CARIDION_GORDONI	CARIDION_GORDONI	HIPPFAM	145
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Eualus	EUALUS_FABRICII	EUALUS_FABRICII	HIPPFAM	1
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Eualus	EUALUS_GAIMARDII	EUALUS_GAIMARDII	HIPPFAM	10
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Eualus	EUALUS_PUSIOLUS	EUALUS_PUSIOLUS	HIPPFAM	91
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Eualus	EUALUS_SP.	EUALUS_SP.	HIPPFAM	8
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Hippolyte	HIPPOLYTE_ZOSTERICOLA	EEL_GRASS_SHRIMP	HIPPFAM	1
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Lebbeus	LEBBEUS_GROENLANDICUS	LEBBEUS_GROENLANDICUS	HIPPFAM	1
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Lebbeus	LEBBEUS_POLARIS	LEBBEUS_POLARIS	HIPPFAM	19

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Lebbeus	LEBBEUS_SP.	LEBBEUS_SP.	HIPPFAM	23
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Lebbeus	LEBBEUS_ZEBRA	LEBBEUS_ZEBRA	HIPPFAM	1
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Spirontocaris	SPIRONTOCARIS_LILJEBORGII	SPIRONTOCARIS_LILJEBORGII	HIPPFAM	21
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Spirontocaris	SPIRONTOCARIS_SP.	SPIRONTOCARIS	HIPPFAM	27
Arthropoda	Malacostraca	Decapoda	Hippolytidae	Spirontocaris	SPIRONTOCARIS_SPINUS	SPIRONTOCARIS_SPINUS	HIPPFAM	33
Arthropoda	Malacostraca	Decapoda	Hippolytidae	null	HIPPOLYTIDAE_F.	HIPPOLYTIDAE_F.	HIPPFAM	316
Arthropoda	Malacostraca	Decapoda	Lithodidae	Lithodes	LITHODES_MAJA	NORTHERN_STONE_CRAB	LITHOFAM	44
Arthropoda	Malacostraca	Decapoda	Lithodidae	null	LITHODES/NEOLITHODES	SPINY_CRAB	LITHOFAM	3
Arthropoda	Malacostraca	Decapoda	Majidae	null	MAJIDAE_F.	SPIDER_CRAB_(NS)	MAJFAM	47
Arthropoda	Malacostraca	Decapoda	Nephropidae	Homarus	HOMARUS_AMERICANUS	AMERICAN_LOBSTER	NEPHFAM	35
Arthropoda	Malacostraca	Decapoda	Nephropidae	Homarus	HOMARUS_AMERICANUS_LARVAE	LOBSTER_LARVAE	NEPHFAM	6
Arthropoda	Malacostraca	Decapoda	Oregoniidae	Chionoecetes	CHIONOECETES_OPILIO	SNOW_CRAB_(QUEEN)	OREGFAM	71
Arthropoda	Malacostraca	Decapoda	Oregoniidae	Chionoecetes	CHIONOECETES_SP._(OBSOLETE)	SPIDER/(QUEEN_SNOW)UNID	OREGFAM	19
Arthropoda	Malacostraca	Decapoda	Oregoniidae	Hyas	HYAS_ARANEUS	TOAD_CRAB	OREGFAM	50
Arthropoda	Malacostraca	Decapoda	Oregoniidae	Hyas	HYAS_COARCTATUS	HYAS_COARCTATUS	OREGFAM	191
Arthropoda	Malacostraca	Decapoda	Oregoniidae	Hyas	HYAS_SP.	TOAD_CRAB_UNIDENT.	OREGFAM	2149
Arthropoda	Malacostraca	Decapoda	Paguridae	Pagurus	PAGURUS_ACADIANUS	PAGURUS_ACADIANUS	PAGFAM	91
Arthropoda	Malacostraca	Decapoda	Paguridae	Pagurus	PAGURUS_ARCUATUS	PAGURUS_ARCUATUS	PAGFAM	1
Arthropoda	Malacostraca	Decapoda	Paguridae	Pagurus	PAGURUS_PUBESCENS	PAGURUS_PUBESCENS	PAGFAM	15
Arthropoda	Malacostraca	Decapoda	Paguridae	Pagurus	PAGURUS_SP.	PAGURUS_SP.	PAGFAM	523
Arthropoda	Malacostraca	Decapoda	Paguridae	null	PAGURIDAE_F.	HERMIT_CRABS	PAGFAM	565
Arthropoda	Malacostraca	Decapoda	Paguridae	null	PAGUROIDEA_S.F.	PAGUROIDEA_S.F.	PAGFAM	1150
Arthropoda	Malacostraca	Decapoda	Palaemonidae	null	PALAEMONIDAE_F.	PALAEMONIDAE_F.	PALAFAM	1
Arthropoda	Malacostraca	Decapoda	Pandalidae	Atlantopandalus	ATLANTOPANDALUS_PROPINQVUS	WAS_P_PROPINQUUS	PANFAM	4
Arthropoda	Malacostraca	Decapoda	Pandalidae	Dichelopandalus	DICHELOPANDALUS_LEPTOCERUS	D_LEPTOCERUS	PANFAM	208
Arthropoda	Malacostraca	Decapoda	Pandalidae	Dichelopandalus	DICHELOPANDALUS_SP.	DICHELOPANDALUS_SP.	PANFAM	28
Arthropoda	Malacostraca	Decapoda	Pandalidae	Pandalus	PANDALUS_BOREALIS	PANDALUS_BOREALIS	PANFAM	208
Arthropoda	Malacostraca	Decapoda	Pandalidae	Pandalus	PANDALUS_MONTAGUI	PANDALUS_MONTAGUI	PANFAM	1487
Arthropoda	Malacostraca	Decapoda	Pandalidae	Pandalus	PANDALUS_SP.	PANDALUS_SP.	PANFAM	949
Arthropoda	Malacostraca	Decapoda	Pandalidae	null	PANDALIDAE_F.	PANDALIDAE_F.	PANFAM	2135
Arthropoda	Malacostraca	Decapoda	Pasiphaeidae	Pasiphaea	PASIPHAEA_MULTIDENTATA	PASIPHAEA_MULTIDENTATA	PASFAM	330
Arthropoda	Malacostraca	Decapoda	Pasiphaeidae	null	PASIPHAEIDAE_F.	PASIPHAEIDAE_F.	PASFAM	10
Arthropoda	Malacostraca	Decapoda	Portunidae	Carcinus	CARCINUS_MAENAS	GREEN_CRAB	PORFAM	2
Arthropoda	Malacostraca	Decapoda	Portunidae	Ovalipes	CRAB_(OVALIPES_SP)	CRAB_(OVALIPES_SP)	PORFAM	3
Arthropoda	Malacostraca	Decapoda	Portunidae	null	PORTUNIDAE_F.	PORTUNIDAE_F.	PORFAM	1
Arthropoda	Malacostraca	Decapoda	Raninoidea	Lyreidus	LYREIDUS_BAIRDII	LYREIDUS_BAIRDII	RANIFAM	1
Arthropoda	Malacostraca	Decapoda	Thalassinidae	null	THALASSINIDAE_S.F.	MUD_SHRIMP	THALFAM	222
Arthropoda	Malacostraca	Decapoda	null	null	BRACHYURA_S.	BRACHIURAN_CRABS	DECA	974
Arthropoda	Malacostraca	Decapoda	null	null	CARIDEA_SO.	CARIDEA_SO	ANNELIDA	2
Arthropoda	Malacostraca	Decapoda	null	null	CRAB	CRAB	DECA	944
Arthropoda	Malacostraca	Decapoda	null	null	CRAB_EGGS	CRAB_EGGS	INVEGGS	16
Arthropoda	Malacostraca	Decapoda	null	null	CRUSTACEAN_REMAINS	CRUSTACEAN_REMAINS	UNID_CRUST	193
Arthropoda	Malacostraca	Decapoda	null	null	CRUSTACEA_C.	CRUSTACEA_C.	UNID_CRUST	899
Arthropoda	Malacostraca	Decapoda	null	null	CRUSTACEA_EGGS	CRUSTACEAN_EGGS	INVEGGS	20
Arthropoda	Malacostraca	Decapoda	null	null	CRUSTACEA_LARVAE	CRUSTACEA_LARVAE	UNID_CRUST	9
Arthropoda	Malacostraca	Decapoda	null	null	DECAPODA_EGGS	DECAPOD_EGGS	INVEGGS	1
Arthropoda	Malacostraca	Decapoda	null	null	DECAPODA_LARVAE	DECAPODA_LARVAE	DECA	33
Arthropoda	Malacostraca	Decapoda	null	null	DECAPODA_O.	SHRIMPS	DECA	7691
Arthropoda	Malacostraca	Decapoda	null	null	HERMIT_CRAB_EGGS	HERMIT_EGGS	INVEGGS	2
Arthropoda	Malacostraca	Decapoda	null	null	PANDALID_EGGS	PANDALID_EGGS	INVEGGS	6

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Arthropoda	Malacostraca	Decapoda	null	null	null	null	DECA	5
Arthropoda	Malacostraca	Euphausiacea	Euphausiidae	Meganyctiphanes	MEGANYCTIPHANES_NORVEGICA	M_NORVEGICA	EUPFAM	2149
Arthropoda	Malacostraca	Euphausiacea	Euphausiidae	Thysanoessa	THYSANOESSA_INERMIS	THYSANOESSA_INERMIS	EUPFAM	42
Arthropoda	Malacostraca	Euphausiacea	Euphausiidae	Thysanoessa	THYSANOESSA_RASCHII	THYSANOESSA_RASCHII	EUPFAM	66
Arthropoda	Malacostraca	Euphausiacea	Euphausiidae	Thysanoessa	THYSANOESSA_SP.	THYSANOESSA_SP.	EUPFAM	4
Arthropoda	Malacostraca	Euphausiacea	null	null	EUPHAUSIACEA_O.	KRILL_SHRIMP	EUPFAM	12166
Arthropoda	Malacostraca	Isopoda	Aegidae	Aega	AEGA_PSORA	AEGA_PSORA	AEGIFAM	6
Arthropoda	Malacostraca	Isopoda	Aegidae	null	AEGIDAE_F.	AEGIDAE_F.	AEGIFAM	5
Arthropoda	Malacostraca	Isopoda	Anthuridea	null	ANTHURIDAE_F.	ANTHURIDAE_F.	ANTHUFAM	1
Arthropoda	Malacostraca	Isopoda	Anthuridea	null	ANTHURIDEA_S.O.	ANTHURIDEA_S.O.	ANTHUFAM	2
Arthropoda	Malacostraca	Isopoda	Bypyrodae	Bopyroides	BOPYROIDES_HIPPOLYTES	BOPYROIDES_HIPPOLYTES	BYPFAM	12
Arthropoda	Malacostraca	Isopoda	Chaetiliidae	Chiridotea	CHIRIDOTEA_SP.	CHIRIDOTEA_SP.	CHAEFAM	40
Arthropoda	Malacostraca	Isopoda	Chaetiliidae	Chiridotea	CHIRIDOTEA_TUFTSI	CHIRIDOTEA_TUFTSI	CHAEFAM	16
Arthropoda	Malacostraca	Isopoda	Cirolanidae	Cirolana	CIROLANA_POLITA	CIROLANA_POLITA	CIROFAM	179
Arthropoda	Malacostraca	Isopoda	Cirolanidae	Cirolana	CIROLANA_SP.	CIROLANA_SP.	CIROFAM	1
Arthropoda	Malacostraca	Isopoda	Idoteidae	Edotea	EDOTEA_TRILOBA	BROWN_ISOPOD	IDOTFAM	4
Arthropoda	Malacostraca	Isopoda	Idoteidae	Idotea	IDOTEA_PHOSPHOREA	IDOTEA_PHOSPHOREA	IDOTFAM	1
Arthropoda	Malacostraca	Isopoda	Idoteidae	Idotea	IDOTEA_SP.	IDOTEA_SP.	IDOTFAM	2
Arthropoda	Malacostraca	Isopoda	Idoteidae	null	IDOTEIDAE_F.	IDOTEIDAE_F.	IDOTFAM	7
Arthropoda	Malacostraca	Isopoda	Janiridae	Jaera	JAERA_MARINA	LITTLE_SHORE_ISOPOD	JANIRFAM	242
Arthropoda	Malacostraca	Isopoda	Janiridae	Janira	JANIRA_ALTA	JANIRA_ALTA	JANIRFAM	1
Arthropoda	Malacostraca	Isopoda	Sphaeromatidae	Sphaeroma	SPHAEROMA_QUADRIDENTATUM	SEA_PILL_BUG	SPHAFAM	12
Arthropoda	Malacostraca	Isopoda	null	null	ISOPODA_O.	ISOPODA_O.	ISOPO	868
Arthropoda	Malacostraca	Isopoda	null	null	ISOPODA_O.	RED_ISOPOD	ISOPO	1
Arthropoda	Malacostraca	Leptostraca	Nebaliidae	Nebalia	NEBALIA_BIPES	NEBALIA_SHRIMP	NEBALFAM	1
Arthropoda	Malacostraca	Leptostraca	Nebaliidae	Nebalia	NEBALIA_SP.	NEBALIA_SP.	NEBALFAM	4
Arthropoda	Malacostraca	Mysida	Mysidae	Erythrops	ERYTHROPS_ERYTHROPTHALMA	E_ERYTHROPTHALMA	MYSFAM	4
Arthropoda	Malacostraca	Mysida	Mysidae	Meterythrops	METERYTHROPS_ROBUSTUS	METERYTHROPS_ROBUSTUS	MYSFAM	1
Arthropoda	Malacostraca	Mysida	Mysidae	Mysis	MYSIS_MIXTA	MYSIS_MIXTA	MYSFAM	15
Arthropoda	Malacostraca	Mysida	Mysidae	Mysis	MYSIS_SP.	MYSIS_SP.	MYSFAM	22
Arthropoda	Malacostraca	Mysidacea	null	null	MYSIDACEA_O.	MYSID_SHRIMP	MYSFAM	763
Arthropoda	Malacostraca	Tanaidacea	Tanaidae	null	TANAIDAE_F.	TANAIDAE_F.	TANAFAM	99
Arthropoda	Maxillopoda	Calanoida	Calanidae	Calanus	CALANUS_FINMARCHICUS	CALANUS_FINMARCHICUS	CALANFAM	4
Arthropoda	Maxillopoda	Calanoida	Calanidae	Calanus	CALANUS_HYPERBOREUS	CALANUS_HYPERBOREUS	CALANFAM	1
Arthropoda	Maxillopoda	Calanoida	Calanidae	Calanus	CALANUS_SP.	CALANUS_SP.	CALANFAM	1
Arthropoda	Maxillopoda	Calanoida	Metridinidae	Metridia	METRIDIA_SP.	METRIDIA_SP.	METRIFAM	1
Arthropoda	Maxillopoda	Calanoida	Temoridae	Temora	TEMORA_SP.	TEMPORA_SP.	TEMOFAM	1
Arthropoda	Maxillopoda	Calanoida	null	null	CALANOIDA_O.	CALANOIDA_O.	CALANFAM	29
Arthropoda	Maxillopoda	Monstrilloida	Monstrillidae	Monstrilla	MONSTRILLA_SP.	COPEPOD	MONSFAM	6
Arthropoda	Maxillopoda	Sessilia	Balanidae	null	BALANIDAE_F.	BALANIDAE_F.	BALANFAM	8
Arthropoda	Maxillopoda	Siphonostomatoida	Caligidae	Caligus	CALIGUS_SP.	CALIGUS_SP.	CALIGFAM	3
Arthropoda	Maxillopoda	null	null	null	CIRRIPEDIA_S.C.	BARNACLES	COPEPODA	71
Arthropoda	Maxillopoda	null	null	null	COPEPODA_S.C.	COPEPODA_S.C.	COPEPODA	577
Arthropoda	Ostracoda	null	null	null	OSTRACODA_S.C.	OSTRACODA_S.C.	UNID_CRUST	54
Arthropoda	Pycnogonida	Pantopoda	Nymphonidae	Nymphon	NYMPHON_LONGITARSE	NYMPHON_LONGITARSE	NYMPHFAM	8
Arthropoda	Pycnogonida	Pantopoda	Nymphonidae	Nymphon	NYMPHON_SP.	NYMPHON_SP.	NYMPHFAM	10
Arthropoda	Pycnogonida	Pycnogonum	Pycnogonidae	Pycnogonum	PYCNOGONUM_LITTORALE	ANEMONE_SEA_SPIDER	PYCNOFAM	5
Arthropoda	Pycnogonida	Pycnogonum	null	null	PYCNOGONIDAE_O.	PYCNOGONIDAE_O.	PYCNOGON	5
Arthropoda	Pycnogonida	null	null	null	PYCNOGONIDA_S.P.	SEA_SPIDER	PYCNOGON	98
Arthropoda	null	null	null	null	SHRIMP-LIKE	SHRIMP-LIKE	OTHER	282

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Arthropoda	null	null	null	null	null	null	OTHER	3
Bryozoa	null	null	null	null	BRYOZOANS_ECTOPROCTA_P.	BRYOZOANS_ECTOPROCTA	BRYOZOANS	3
Bryozoa	null	null	null	null	BRYOZOANS_P.	BRYOZOANS_P.	BRYOZOANS	16
CHAETOGNATHA	Saggittoidea	Aphragmorpha	Sagittidae	Sagitta	SAGITTA_ELEGANS	SAGITTA_ELEGANS	CHAETOGN	2
CHAETOGNATHA	Saggittoidea	Aphragmorpha	Sagittidae	Sagitta	SAGITTA_SP.	ARROW_WORMS	SAGITFAM	4
CHAETOGNATHA	null	null	null	null	CHAETOGNATHA_P.	ARROW_WORMS	CHAETOGN	70
Chordata	Actinopterygii	Anguilliformes	Anguillidae	Anguilla	ANGUILLA_ROSTRATA	AMERICAN_EEL	ANGFAM	26
Chordata	Actinopterygii	Anguilliformes	Anguillidae	null	ANGUILLIDAE_F.	EEL-UNIDENTIFIED	ANGFAM	1
Chordata	Actinopterygii	Anguilliformes	Congridae	Conger	CONGER_SP.	CONGER_SP.	CONFAM	2
Chordata	Actinopterygii	Anguilliformes	Derichthyidae	Derichthys	DERICHTHYS_SERPENTINUS	DERICHTHYS_SERPENTINUS	DERFAM	1
Chordata	Actinopterygii	Anguilliformes	Nemichthyidae	Nemichthys	NEMICHTHYS_SCOLOPACEUS	SNIPE_EEL	NEMFAM	4
Chordata	Actinopterygii	Anguilliformes	Ophichthidae	Ophichthus	OPHICHTHUS_CRUENTIFER	SNAKE_EEL	OPHFAM	4
Chordata	Actinopterygii	Anguilliformes	Serrivomeridae	Serrivomer	SERRIVOMER_BEANI	STOUT_SAWPALATE	SERFAM	3
Chordata	Actinopterygii	Anguilliformes	Synaphobranchidae	Simenchelys	SIMENCHELYS_PARASITICA	SNUBNOSE_EEL__SLIME_EEL	SYNFAM	1
Chordata	Actinopterygii	Aulopiformes	Alepisauridae	Alepisaurus	ALEPISAURUS_FEROX	LONGNOSE_LANCETFISH	ALEFAM	2
Chordata	Actinopterygii	Aulopiformes	Paralepididae	Arctozenus	NOTOLEPIS_RISSOI	WHITE_BARRACUDINA	PARFAM	4
Chordata	Actinopterygii	Aulopiformes	Paralepididae	Magnisudis	PARALEPIS_ATLANTICA	SHORT_BARRACUDINA	PARFAM	12
Chordata	Actinopterygii	Aulopiformes	Paralepididae	null	PARALEPIDIDAE_F.	BARRACUDINA_UNIDENTIFIED	PARFAM	3
Chordata	Actinopterygii	Beloniformes	Scomberesocidae	Scomberesox	SCOMBERESOX_SAURUS	ATLANTIC_SAURY	SCOFAM	10
Chordata	Actinopterygii	Beryciformes	Holocentridae	Sargocentron	SARGOCENTRON_BULLISI	SARGOCENTRON_BULLISI	HOLOFAM	1
Chordata	Actinopterygii	Clupeiformes	Clupeidae	Alosa	ALOSA_PSEUDOHARENGUS	ALEWIFE	CLUFAM	12
Chordata	Actinopterygii	Clupeiformes	Clupeidae	Clupea	CLUPEA_HARENGUS	HERRING(ATLANTIC)	CLUFAM	1153
Chordata	Actinopterygii	Clupeiformes	Clupeidae	Eggs	CLUPEA_HARENGUS_EGGS	HERRING_EGGS	CLUFAM	2
Chordata	Actinopterygii	Clupeiformes	Clupeidae	null	CLUPEIDAE_F.	HERRING_(NS)	CLUFAM	1
Chordata	Actinopterygii	Clupeiformes	engraulidae	Anchoa	ANCHOA_MITCHILLI	BAY_ANCHOVY	ENGFAM	1
Chordata	Actinopterygii	Gadiformes	Gadidae	Brosme	BROSME_BROSME	CUSK	GADFAM	10
Chordata	Actinopterygii	Gadiformes	Gadidae	Eggs	MELANOGRAMMUS_AEGLEFINUS_EGGS	HADDOCK_EGGS	GADFAM	1
Chordata	Actinopterygii	Gadiformes	Gadidae	Enchelyopus	ENCHELYOPUS_CIMBRIUS	FOURBEARD_ROCKLING	GADFAM	3
Chordata	Actinopterygii	Gadiformes	Gadidae	Gadus	GADUS_MORHUA	COD(ATLANTIC)	GADFAM	285
Chordata	Actinopterygii	Gadiformes	Gadidae	Gaidropsarus	GAIDROPSARUS_SP.	ROCKLING_UNIDENTIFIED	GADFAM	41
Chordata	Actinopterygii	Gadiformes	Gadidae	Melanogrammus	MELANOGRAMMUS_AEGLEFINUS	HADDOCK	GADFAM	262
Chordata	Actinopterygii	Gadiformes	Gadidae	Phycis	UROPHYCIS_CHESTERI	LONGFIN_HAKE	GADFAM	2
Chordata	Actinopterygii	Gadiformes	Gadidae	Pollachius	POLLACHIUS_VIRENS	POLLOCK	GADFAM	60
Chordata	Actinopterygii	Gadiformes	Gadidae	Urophycis	UROPHYCIS_CHUSS	SQUIRREL_OR_RED_HAKE	GADFAM	50
Chordata	Actinopterygii	Gadiformes	Gadidae	Urophycis	UROPHYCIS_SP.	HAKE_(NS)	GADFAM	2
Chordata	Actinopterygii	Gadiformes	Gadidae	Urophycis	UROPHYCIS_TENUIS	WHITE_HAKE	GADFAM	85
Chordata	Actinopterygii	Gadiformes	Gadidae	null	GADIDAE_F.	GADOIDS_(COD)	GADFAM	40
Chordata	Actinopterygii	Gadiformes	Macrouridae	Coryphaenoides	CORYPHAENOIDES_RUPESTRIS	ROCK_GRENADIER	MACFAM	2
Chordata	Actinopterygii	Gadiformes	Macrouridae	Macrourus	MACROURUS_BERGLAX	ROUGHHEAD_GRENADIER	MACFAM	5
Chordata	Actinopterygii	Gadiformes	Macrouridae	Nezumia	NEZUMIA_BAIRDII	MARLIN-SPIKE_GRENADIER	MACFAM	6
Chordata	Actinopterygii	Gadiformes	Macrouridae	null	MACROURIDAE_F.	GRENADIERS_(NS)	MACFAM	14
Chordata	Actinopterygii	Gadiformes	Merlucciidae	Merluccius	MERLUCCIUS_ALBIDUS	OFF-SHORE_HAKE	MERFAM	5
Chordata	Actinopterygii	Gadiformes	Merlucciidae	Merluccius	MERLUCCIUS_BILINEARIS	SILVER_HAKE	MERFAM	1066
Chordata	Actinopterygii	Gadiformes	null	null	GADIFORMES	HAKE_(NS)	GADFAM	11
Chordata	Actinopterygii	Gadiformes	null	null	GADOIDEI_S.O.	GADOIDS	GADFAM	36
Chordata	Actinopterygii	Gasterosteiformes	Syngnathidae	Syngnathus	SYNGNATHUS_FUSCUS	NORTHERN_PIPEFISH	SYNFAM	1
Chordata	Actinopterygii	Lophiiformes	Lophiidae	Lophius	LOPHIUS_AMERICANUS	MONKFISH	LOPFAM	5
Chordata	Actinopterygii	Myctophiformes	Myctophidae	Ceratoscopelus	CERATOSCOPELUS_MADERENSIS	LANTERNFISH_HORNED	MYCFAM	5
Chordata	Actinopterygii	Myctophiformes	Myctophidae	Diaphus	DIAPHUS_METOPOCLAMPUS	HEADLIGHT_FISH	MYCFAM	5
Chordata	Actinopterygii	Myctophiformes	Myctophidae	Myctophum	MYCTOPHUM_AFFINE	METALLIC_LANTERNFISH	MYCFAM	1

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Chordata	Actinopterygii	Myctophiformes	Myctophidae	Myctophum	MYCTOPHUM_SP.	MYCTOPHUM_SP.	MYCFAM	5
Chordata	Actinopterygii	Myctophiformes	Myctophidae	null	MYCTOPHIDAE	LANTERNFISH_(NS)	MYCFAM	227
Chordata	Actinopterygii	Myctophiformes	null	null	MYCTOPHIFORMES_O.	MYCTOPHIFORMES	MYCFAM	1
Chordata	Actinopterygii	Osmeriformes	Argentinidae	Argentina	ARGENTINA_SILUS	ARGENTINE(ATLANTIC)	ARGFAM	101
Chordata	Actinopterygii	Osmeriformes	Argentinidae	Argentina	ARGENTINA_STRIATA	STRIATED_ARGENTINE	ARGFAM	335
Chordata	Actinopterygii	Osmeriformes	Osmeridae	Mallotus	MALLOTUS_VILLOSUS	CAPELIN	OSFAM	231
Chordata	Actinopterygii	Osmeriformes	Osmeridae	Osmerus	OSMERUS_MORDAX	RAINBOW_SMELT	OSFAM	1
Chordata	Actinopterygii	Perciformes	Ammodytidae	Ammodytes	AMMODYTES_AMERICANUS	AMERICAN_SAND_LANCE	AMMFAM	75
Chordata	Actinopterygii	Perciformes	Ammodytidae	Ammodytes	AMMODYTES_DUBIUS	NORTHERN_SAND_LANCE	AMMFAM	4552
Chordata	Actinopterygii	Perciformes	Ammodytidae	Ammodytes	AMMODYTES_SP.	SAND_LANCE_(NS)	AMMFAM	20
Chordata	Actinopterygii	Perciformes	Ammodytidae	Eggs	AMMODYTES_EGGS	SAND_LANCE_EGGS	AMMFAM	26
Chordata	Actinopterygii	Perciformes	Anarhichadidae	Anarhichas	ANARHICHAS_LUPUS	ATLANTIC_WOLFFISH	ANAFAM	30
Chordata	Actinopterygii	Perciformes	Anarhichadidae	Anarhichas	ANARHICHAS_MINOR	SPOTTED_WOLFFISH	ANAFAM	4
Chordata	Actinopterygii	Perciformes	Anarhichadidae	null	ANARHICHADIDAE_F.	WOLFFISH_UNIDENT.	ANAFAM	22
Chordata	Actinopterygii	Perciformes	Cryptacanthodidae	Cryptacanthodes	CRYPTACANTHODES_MACULATUS	WRYMOUTH	CRYFAM	2
Chordata	Actinopterygii	Perciformes	Labridae	Tautogolabrus	TAUTOGOLABRUS_ADSPERSUS	CUNNER	LABFAM	4
Chordata	Actinopterygii	Perciformes	Pholidae	Pholis	PHOLIS_GUNNELLUS	ROCK_GUNNEL(EEL)	PHOFAM	12
Chordata	Actinopterygii	Perciformes	Scombridae	Scomber	SCOMBER_SCOMBRUS	MACKEREL(ATLANTIC)	SCOFAM	41
Chordata	Actinopterygii	Perciformes	Scombridae	Scomber	SCOMBER_colias	CHUB_MACKEREL	SCOFAM	1
Chordata	Actinopterygii	Perciformes	Stichaeidae	Leptoclinus	LUMPENUS_MACULATUS	DAUBED_SHANNY	STIFAM	92
Chordata	Actinopterygii	Perciformes	Stichaeidae	Lumpenus	LUMPENUS_LUMPRETAEFORMIS	SNAKE_BLENNY	STIFAM	72
Chordata	Actinopterygii	Perciformes	Stichaeidae	Stichaeus	STICHAEUS_PUNCTATUS	ARCTIC_SHANNY	STIFAM	1
Chordata	Actinopterygii	Perciformes	Stichaeidae	Ulvaria	ULVARIA_SUBBIFURCATA	RADIATED_SHANNY	STIFAM	7
Chordata	Actinopterygii	Perciformes	Stichaeidae	null	STICHAEIDAE_F.	PRICKLEBACKS	STIFAM	2
Chordata	Actinopterygii	Perciformes	Stromateidae	Peprilus	PEPRILUS_TRIACANTHUS	BUTTERFISH	STRFAM	16
Chordata	Actinopterygii	Perciformes	Xiphiidae	Xiphias	XIPHIAS_GLADIUS	SWORDFISH	XIPHFAM	1
Chordata	Actinopterygii	Perciformes	Zoarcidae	Lycenchelys	LYCENCHELYS_PAXILLUS	COMMON_WOLF_EEL	ZOAFAM	2
Chordata	Actinopterygii	Perciformes	Zoarcidae	Lycenchelys	LYCENCHELYS_VERRILLI	WOLF_EELPOUT	ZOAFAM	1
Chordata	Actinopterygii	Perciformes	Zoarcidae	Lycodes	LYCODES_RETICULATUS	ARCTIC_EELPOUT	ZOAFAM	2
Chordata	Actinopterygii	Perciformes	Zoarcidae	Lycodes	LYCODES_SP.	EELPOUTS(NS)	ZOAFAM	70
Chordata	Actinopterygii	Perciformes	Zoarcidae	Lycodes	LYCODES_TERRAENOVA	EELPOUT_NEWFOUNDLAND	ZOAFAM	1
Chordata	Actinopterygii	Perciformes	Zoarcidae	Lycodes	LYCODES_VAHLII	EELPOUT(VAHL)	ZOAFAM	11
Chordata	Actinopterygii	Perciformes	Zoarcidae	Melanostigma	MELANOSTIGMA_ATLANTICUM	ATLANTIC_SOFT_POUT	ZOAFAM	1
Chordata	Actinopterygii	Perciformes	Zoarcidae	Zoarces	MACROZOARCES_AMERICANUS	OCEAN_POUT(COMMON)	ZOAFAM	38
Chordata	Actinopterygii	Perciformes	Zoarcidae	null	ZOARCIDAE_F.	EELPOUTS_(NS)	ZOAFAM	2
Chordata	Actinopterygii	Perciformes	null	null	BLENNIOIDEI_S.O.	BLENNIE-SHANNIE-GUNNEL	OTHERFISH	2
Chordata	Actinopterygii	Perciformes	null	null	BLENNIOIDEI_S.O.	BLENNIES_SHANNIE_GUNNEL	OTHERFISH	6
Chordata	Actinopterygii	Pleuronectiformes	Paralichthyidae	Citharichthys	CITHARICHTHYS_ARCTIFRONS	GULF_STREAM_FLOUNDER	PLEFAM	1
Chordata	Actinopterygii	Pleuronectiformes	Pleuronectidae	Glyptocephalus	GLYPTOCEPHALUS_CYNOGLOSSUS	WITCH_FLOUNDER	PLEFAM	27
Chordata	Actinopterygii	Pleuronectiformes	Pleuronectidae	Hippoglossoides	HIPPOGLOSSOIDES_PLATESSOIDES	AMERICAN_PLAICE	PLEFAM	229
Chordata	Actinopterygii	Pleuronectiformes	Pleuronectidae	Hippoglossus	HIPPOGLOSSUS_HIPPOGLOSSUS	HALIBUT(ATLANTIC)	PLEFAM	1
Chordata	Actinopterygii	Pleuronectiformes	Pleuronectidae	Limanda	LIMANDA_FERRUGINEA	YELLOWTAIL_FLOUNDER	PLEFAM	34
Chordata	Actinopterygii	Pleuronectiformes	Pleuronectidae	Pseudopleuronectes	PSEUDOPLEURONECTES_AMERICANUS	WINTER_FLOUNDER	PLEFAM	5
Chordata	Actinopterygii	Pleuronectiformes	Pleuronectidae	Reinhardtius	REINHARDTIUS_HIPPOGLOSSOIDES	GREENLAND_HALIBUT	PLEFAM	3
Chordata	Actinopterygii	Pleuronectiformes	Pleuronectidae	null	PLEURONECTIDAE_F.	FLOUNDER_UNIDENTIFIED	PLEFAM	184
Chordata	Actinopterygii	Pleuronectiformes	null	null	PLEURONECTIFORMES_O.	FLATFISH	PLEFAM	7
Chordata	Actinopterygii	Scorpaeniformes	Agonidae	Aspidophoroides	ASPIDOPHOROIDES_MONOPTERYGIUS	ALLIGATORFISH	AGOFAM	15
Chordata	Actinopterygii	Scorpaeniformes	Agonidae	null	AGONIDAE_F.	ALLIGATOR_FISH_(NS)	AGOFAM	10
Chordata	Actinopterygii	Scorpaeniformes	Cottidae	Artediellus	ARTEDIELLUS_ATLANTICUS	HOOKEAR_SCULPIN_ATL.	COTFAM	6
Chordata	Actinopterygii	Scorpaeniformes	Cottidae	Artediellus	ARTEDIELLUS_SP.	HOOKEAR_SCULPIN_(NS)	COTFAM	1

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Chordata	Actinopterygii	Scorpaeniformes	Cottidae	Artediellus	ARTEDIELLUS_UNCINATUS	ARCTIC_HOOKEAR_SCULPIN	COTFAM	28
Chordata	Actinopterygii	Scorpaeniformes	Cottidae	Eggs	MYOXOCEPHALUS_EGGS	SCULPIN_EGGS_UNID.	COTFAM	48
Chordata	Actinopterygii	Scorpaeniformes	Cottidae	Myoxocephalus	MYOXOCEPHALUS_OCTODECEMSPINOSUS	LONGHORN_SCULPIN	COTFAM	72
Chordata	Actinopterygii	Scorpaeniformes	Cottidae	Myoxocephalus	MYOXOCEPHALUS_SCORPIOIDES	ARCTIC_SCULPIN	COTFAM	2
Chordata	Actinopterygii	Scorpaeniformes	Cottidae	Myoxocephalus	MYOXOCEPHALUS_SCORPIUS	SHORTHORN_SCULPIN	COTFAM	10
Chordata	Actinopterygii	Scorpaeniformes	Cottidae	Triglops	TRIGLOPS_MURRAYI	MAILED_SCULPIN	COTFAM	42
Chordata	Actinopterygii	Scorpaeniformes	Cottidae	Triglops	TRIGLOPS_NYBELINI	NYBELIN_S_SCULPIN	COTFAM	24
Chordata	Actinopterygii	Scorpaeniformes	Cottidae	null	COTTIDAE_F.	SCULPINS	COTFAM	82
Chordata	Actinopterygii	Scorpaeniformes	Cottidae	null	COTTIDAE_F._UNID.	SCULPIN_UNIDENTIFIED	COTFAM	3
Chordata	Actinopterygii	Scorpaeniformes	Cyclopteridae	Cyclopterus	CYCLOPTERUS_LUMPUS	LUMPFISH	CYCFAM	6
Chordata	Actinopterygii	Scorpaeniformes	Cyclopteridae	Eggs	CYCLOPTERUS_LUMPUS_EGGS	LUMPFISH__EGGS	CYCFAM	3
Chordata	Actinopterygii	Scorpaeniformes	Cyclopteridae	Eumicrotremus	EUMICROTREMUS_SPINOSUS	SPINY_LUMPSUCKER	CYCFAM	2
Chordata	Actinopterygii	Scorpaeniformes	Hemitripteridae	Hemitripterus	HEMITRIPTERUS_AMERICANUS	SEA_RAVEN	COTFAM	13
Chordata	Actinopterygii	Scorpaeniformes	Liparidae	Liparis	LIPARIS_FABRICII	SEASNAIL_GELATINOUS	LIPFAM	1
Chordata	Actinopterygii	Scorpaeniformes	Liparidae	Liparis	LIPARIS_LIPARIS	STRIPED_SEASNAIL	LIPFAM	1
Chordata	Actinopterygii	Scorpaeniformes	Liparidae	Liparis	LIPARIS_SP.	SEASNAIL_UNIDENTIFIED	LIPFAM	1
Chordata	Actinopterygii	Scorpaeniformes	Scorpaenidae	Ectreposebastes	ECTREPOSEBASTES_IMUS	ECTREPOSEBASTES_IMUS	SCRFAM	126
Chordata	Actinopterygii	Scorpaeniformes	Scorpaenidae	Helicolenus	HELICOLENUS_DACTYLOPTERUS	ROSEFISH(BLACK_BELLY)	SCRFAM	6
Chordata	Actinopterygii	Scorpaeniformes	Scorpaenidae	Sebastes	BONAPARTIA_PEDIOLOTA	BONAPARTIA_PEDIOLOTA	SCRFAM	223
Chordata	Actinopterygii	Scorpaeniformes	Scorpaenidae	Sebastes	SEBASTES_MARINUS	REDFISH	SCRFAM	28
Chordata	Actinopterygii	Scorpaeniformes	Scorpaenidae	Sebastes	SEBASTES_MENTELLA	REDFISH__DEEP_WATER	SCRFAM	6
Chordata	Actinopterygii	Scorpaeniformes	Scorpaenidae	Sebastes	SEBASTES_SP.	REDFISH_UNSEPARATED	SCRFAM	294
Chordata	Actinopterygii	Scorpaeniformes	null	null	SCORPAENIFORMES_(ORDER)	SCORPAENIFORMES_(ORDER)	COTFAM	1
Chordata	Actinopterygii	Stomiiformes	Stomiidae	Stomias	STOMIAS_BOA	BOA_DRAGONFISH	STOMFAM	3
Chordata	Actinopterygii	Stomiiformes	Stomiidae	Trigonolampa	TRIGONOLAMPA_MIRICEPS	THREELIGHT_DRAGONFISH	STOMFAM	5
Chordata	Actinopterygii	Tetradontiformes	Balistidae	Balistes	BALISTES_VETULA	QUEEN_TRIGGERFISH	BALFAM	56
Chordata	Actinopterygii	null	null	null	ARGYROPELECUS_AFFINIS	ARGYROPELECUS_AFFINIS	OTHERFISH	2
Chordata	Actinopterygii	null	null	null	CARCHARHINUS_ALTIMUS	BIGNOSE_SHARK	OTHERFISH	1
Chordata	Actinopterygii	null	null	null	CLUPEIDAE/OSMERIDAE_F.	HERRING/CAPELIN_LIKE	OTHERFISH	1
Chordata	Actinopterygii	null	null	null	COD/HADDOCK/WITCH_EGGS	COD/HADDOCK/WITCH_EGGS	FISH_EGGS	1
Chordata	Actinopterygii	null	null	null	EGGS_UNID	EGGS_UNID	FISH_EGGS	59
Chordata	Actinopterygii	null	null	null	FINFISHES_(NS)	FINFISHES_(NS)	OTHERFISH	24
Chordata	Actinopterygii	null	null	null	FISH_EGGS-UNIDENTIFIED	FISH_EGGS-UNIDENTIFIED	FISH_EGGS	325
Chordata	Actinopterygii	null	null	null	FISH_LARV_UNID	FISH_LARV_UNID	FISH_LARVAE	42
Chordata	Actinopterygii	null	null	null	FISH_REMAINS	FISH_REMAINS	OTHERFISH	906
Chordata	Actinopterygii	null	null	null	OSTEICHTHYES_C.	FISHES_BONY_(NS)	OTHERFISH	1
Chordata	Actinopterygii	null	null	null	PELAGIC_FISH_(NS)	PELAGIC_FISH_(NS)	OTHERFISH	2
Chordata	Actinopterygii	null	null	null	UNID._FISH_(LARVAE_JUVENILE_AND_ADULTS)	UNID._FISH	OTHERFISH	2867
Chordata	Actinopterygii	null	null	null	UNID_FISH	UNID._FISH	OTHERFISH	5320
Chordata	Actinopterygii	null	null	null	UNID_FISH_AND_EGGS	UNID_FISH_AND_EGGS	OTHER	3
Chordata	Actinopterygii	null	null	null	UNID_FISH_AND_REMAINS	UNID_FISH_AND_REMAINS	OTHER	400
Chordata	Ascidiacea	Enterogona	Ascidiidae	Ascidia	ASCIDIA_SP.	SEA_SQUIRTS	ASCIDIA	120
Chordata	Ascidiacea	Enterogona	Ascidiidae	Ascidia	ASCIDIA_SP._ADULT	ADULT_ASCIDIANS	ASCIDIA	27
Chordata	Ascidiacea	Enterogona	Ascidiidae	Ascidia	ASCIDIA_SP._LARVAL	LARVAL_ASCIDIANS	ASCIDIA	38
Chordata	Ascidiacea	Pleurogona	Molgulidae	Molgula	MOLGULA_MANHATTENSIS	SEA_GRAPES	ASCIDIA	1
Chordata	Ascidiacea	Pleurogona	Molgulidae	null	MOLGULIDAE_F.	MOLGULIDAE_F.	MOLFAM	1
Chordata	Ascidiacea	Pleurogona	Pyuridae	Boltenia	BOLTENIA_SP.	SEA_POTATO	ASCIDIA	6
Chordata	Ascidiacea	Pleurogona	Pyuridae	Halocynthia	HALOCYNTHIA_PYRIFORMIS	SEA_PEACH	ASCIDIA	151
Chordata	Chondrichthyes	Rajiformes	Rajidae	Amblyraja	AMBLYRAJA_RADIATA	THORNY_SKATE	RAJFAM	7
Chordata	Chondrichthyes	Rajiformes	Rajidae	Dipturus	DIPTURUS_LAEVIS	BARNDOOR_SKATE	RAJFAM	1

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Chordata	Chondrichthyes	Rajiformes	Rajidae	Eggs	RAJA_EGGS	SKATE_UNID._EGGS	RAJFAM	15
Chordata	Chondrichthyes	Rajiformes	Rajidae	null	RAJIDAE_F.	SKATES_(NS)	RAJFAM	9
Chordata	Chondrichthyes	Rajiformes	null	null	RAJIFORMES	SKATES_AND_RAYS_(NS)	RAJFAM	1
Chordata	Chondrichthyes	Squaliformes	Squalidae	Squalus	SQUALUS_ACANTHIAS	SPINY_DOGFISH	RAJFAM	2
Chordata	Larvaecea	null	null	null	LARVACEA_C.	LARVACEA_C.	LARVACEA	36
Chordata	Leptocardii	Amphioxiformes	Branchiostomidae	Amphioxus	AMPHIOXUS_SP.	SAND_BLISTERS	LARVACEA	216
Chordata	Myxini	Myxiniformes	Myxinidae	Myxine	MYXINE_GLUTINOSA	NORTHERN_HAGFISH	MYXFAM	1
Chordata	Unid	null	null	null	null	null	OTHERFISH	1
Chordata	null	null	null	null	PROTOCHORDATA_SP.	PROTOCHORDATA_SP.	PROTOCHO	1
Chordata	null	null	null	null	TUNICATA_S.P.	TUNICATA_S.P.	TUNICATA	334
Cnidaria	Anthozoa	Actiniaria	Metridiidae	Metridium	METRIDIUMSENILE	METRIDIUMSENILE	METRIFAM	25
Cnidaria	Anthozoa	Actiniaria	null	null	ACTINIARIA	SEAANEMONES	CNIDARIA	12
Cnidaria	Anthozoa	Ceriantharia	Cerianthidae	Cerianthus	CERIANTHUS_BOREALIS	CERIANTHUSBOREALIS	CERIAFAM	1
Cnidaria	Anthozoa	Pennatulacea	Pennatulidae	Pennatula	PENNATULABOREALIS	SEA_PEN	PENNAFAM	4
Cnidaria	Anthozoa	null	null	null	ANTHOZOA	SEAANEMONE	CNIDARIA	493
Cnidaria	Anthozoa	null	null	null	SEA_CORALS_(NS)	SEA_CORALS_(NS)	CNIDARIA	24
Cnidaria	Hydrozoa	null	null	null	HYDROZOA	HYDROZOAC	CNIDARIA	114
Cnidaria	Scyphozoa	null	null	null	SCYPHOZOA	JELLYFISHES	CNIDARIA	91
Coelenterata	null	null	null	null	COELENTERATA_P.	COELENTERATA_P.	OTHER_INV	94
Ctenophora	Tentaculata	Cydippida	Pleurobrachiidae	Pleurobrachia	PLEUROBRACHIA_SP.	PLEUROBRACHIA_SP.	PLEURFAM	4
Ctenophora	null	null	null	null	CTENOPHORA_P.	COMB_JELLIES	CTENOPHOR	693
Ctenophora	null	null	null	null	CTENOPHORES_COELENTERATES_PORIFERA_P.	CTENOP_COELENTE_PORIF	CTENOPHOR	194
Echinodermata	Asteroidea	Forcipulatida	Asteriidae	Asterias	ASTERIAS_SP	ASTERIAS_SP.	ASTERFAM	4
Echinodermata	Asteroidea	Forcipulatida	Asteriidae	Asterias	ASTERIAS_VULGARIS	PURPLE_STARFISH	ASTERFAM	89
Echinodermata	Asteroidea	Paxillosida	Astropectinidae	Psilaster	PSILASTER_ARCHASTER	PSILASTER_ARCHASTER	ASTROFAM	1
Echinodermata	Asteroidea	Paxillosida	Goniopectinidae	Ctenodiscus	CTENODISCUS_CRISPATUS	MUD_STAR	GONIOFAM	25
Echinodermata	Asteroidea	Spinulosida	Echinasteridae	Henricia	HENRICIA_SANGUINOLENTA	BLOOD_STAR	ECHINFAM	2
Echinodermata	Asteroidea	Spinulosida	Solasteridae	Crossaster	SOLASTER_PAPPOSUS	SUN_STAR	SOLASFAM	6
Echinodermata	Asteroidea	Spinulosida	Solasteridae	Solaster	SOLASTER_ENDECA	PURPLE_SUNSTAR	SOLASFAM	4
Echinodermata	Asteroidea	Valvatida	Goniasteridae	Hippasteria	HIPPASTERIA_PHRYGIANA	HIPPASTERIA_PHRYGIANA	GONIAFAM	1
Echinodermata	Asteroidea	null	null	null	ASTEROIDEA_S.C.	ASTEROIDEA_S.C.	ASTEROIDEA	254
Echinodermata	Crinoidea	null	null	null	CRINOIDEA_C.	SEA_LILIES	ECHINODE	16
Echinodermata	Echinoidea	Arbacioida	Arbaciidae	Arbacia	ARABACIA_SP.	ARABACIA_SP.	ARBACFAM	25
Echinodermata	Echinoidea	Arbacioida	Arbaciidae	Arbacia	ARBACIA_PUNCTULATA	PURPLE-SPINED_SEA_URCHIN	ARBACFAM	1
Echinodermata	Echinoidea	Clypeasteroida	Echinarachniidae	Echinarachnius	ECHINARACHNIUS_PARMA	ECHINARACHNIUS_PARMA	ECHINFAM	225
Echinodermata	Echinoidea	Clypeasteroida	null	null	CLYPEASTEROIDA_O.	SAND_DOLLARS	ECHINODE	1429
Echinodermata	Echinoidea	Echinoida	Strongylocentrotidae	Strongylocentrotus	STRONGYLOCENTROTUS_DROEBACHIENSIS	S_DROEBACHIENSIS	STRONFAM	238
Echinodermata	Echinoidea	Echinoida	Strongylocentrotidae	Strongylocentrotus	STRONGYLOCENTROTUS_SP	SEA_URCHINS	STRONFAM	1836
Echinodermata	Echinoidea	Spatangoida	Schizasteridae	Brisaster	BRISASTER_FRAGILIS	HEART_URCHIN	SCHIZFAM	20
Echinodermata	Echinoidea	null	null	null	ECHINOIDEA_C.	ECHINOIDEA_C.	ECHINODE	14
Echinodermata	Holothuroidea	Apodida	Chiridotidae	Chiridota	CHIRIDOTA_LAEVIS	CHIRIDOTA_LAEVIS	CHIRIFAM	1
Echinodermata	Holothuroidea	Dendrochirotida	Cucumeriidae	Cucumaria	CUCUMARIA_FRONDOSA	CUCUMARIA_FRONDOSA	CUCUMFAM	1
Echinodermata	Holothuroidea	Dendrochirotida	Cucumeriidae	Duasmodactyla	DUASMODACTYLA_COMMUNE	DUASMODACTYLA_COMMUNE	CUCUMFAM	4
Echinodermata	Holothuroidea	Dendrochirotida	Cucumeriidae	Thyone	THYONE_SP.	THYONE_SP.	CUCUMFAM	15
Echinodermata	Holothuroidea	Dendrochirotida	Phyllophoridae	Havelockia	HAVELOCKIA_SCABRA	HAVELOCKIA_SCABRA	PHYLLFAM	158
Echinodermata	Holothuroidea	Dendrochirotida	Phyllophoridae	null	PHYLLOPHORIDAE_F.	PHYLLOPHORIDAE_F.	PHYLLFAM	1
Echinodermata	Holothuroidea	Dendrochirotida	Psolidae	Psolus	PSOLUSES_THYONES_ETC._(NS)	P_THYONES_ETC._(NS)	PSOLIFAM	71
Echinodermata	Holothuroidea	Dendrochirotida	Psolidae	Psolus	PSOLUS_FABRICII	SCARLETT_PSOLUS	PSOLIFAM	34
Echinodermata	Holothuroidea	Dendrochirotida	Psolidae	Psolus	PSOLUS_PHANTAPUS	PSOLUS_PHANTAPUS	PSOLIFAM	27
Echinodermata	Holothuroidea	Dendrochirotida	Psolidae	Psolus	PSOLUS_SP.	PSOLUS_SP.	PSOLIFAM	3

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Echinodermata	Holothuroidea	Molpadiida	Caudinidae	Caudina	CAUDINA_ARENATA	CAUDINA_ARENATA	CAUDIFAM	1
Echinodermata	Holothuroidea	Molpadiida	Molpadiidae	Molpadia	MOLPADIA_SP.	MOLPADIA_SP.	MOLPAFAM	1
Echinodermata	Holothuroidea	null	null	null	HOLOTHUROIDEA_C.	SEA_CUCUMBERS	ECHINODE	1274
Echinodermata	Ophiuroidea	Ophiurida	Ophiactidae	Ophiopholis	OPHIOPHOLIS_ACULEATA	DAISY	OPHIAFAM	949
Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	Ophiura	OPHIURA_ROBUSTA	OPHIURA_ROBUSTA	OPHIUFAM	19
Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	Ophiura	OPHIURA_SARSI	OPHIURA_SARSI	OPHIUFAM	69
Echinodermata	Ophiuroidea	Ophiurida	Ophiuridae	Ophiura	OPHIURA_SP.	OPHIURA_SP.	OPHIUFAM	984
Echinodermata	Ophiuroidea	Phynophiurida	Gorgonocephalidae	null	GORGONOCEPHALIDAE_ASTERONYCHIDAE_F.	BASKET_STARS	GORGOFAM	49
Echinodermata	Ophiuroidea	Phynophiurida	Gorgonocephalidae	null	GORGONOCEPHALIDA_F.	GORGONOCEPHALIDA_F.	GORGOFAM	1
Echinodermata	Ophiuroidea	null	null	null	OPHIUROIDEA_S.C.	BRITTLE_STAR	OPHIUROID	9158
Echinodermata	null	null	null	null	ECHINODERMATA_P.	SPINY_SKINNED_ANIMALS	ECHINODE	1564
Echinodermata	null	null	null	null	ECHINODERM_REMAINS	ECHINODERM_REMAINS	ECHINODE	53
Echinodermata	null	null	null	null	null	null	ECHINODE	2
Foraminifera	null	null	null	null	FORAMINIFERA_O.	FORAMINIFERA	FORAMIN	17
Heterokontophyta	Phaeophyceae	null	null	null	PHAEOPHYCEAE_C.	BROWN_SEAWEEDS	SEAWEED	1
Mollusca	Aplacophora	Chaetodermomorpha	Chaetodermatidae	Chaetoderma	CHAETODERMA_SP.	CHAETODERMA_SP.	CHAETFAM	1
Mollusca	Bivalvia	Arcoida	Arcidae	Anadara	BLOOK_ARK	BLOOK_ARK	ARCIDFAM	81
Mollusca	Bivalvia	Arcoida	Arcidae	Bathyarca	BATHYARCA_PECTUNCULOIDES	B_PECTUNCULOIDES	ARCIDFAM	1
Mollusca	Bivalvia	Arcoida	Arcidae	Bathyarca	BATHYARCA_SP.	BATHYARCA_SP.	ARCIDFAM	2
Mollusca	Bivalvia	Limoida	Limidae	Limatula	LIMATULA_SP.	LIMATULA_SP.	LIMIDFAM	4
Mollusca	Bivalvia	Myoida	Hiatellidae	Cyrtodaria	CYRTODARIA_SILIQUA	BANK_CLAM	HIATEFAM	670
Mollusca	Bivalvia	Myoida	Hiatellidae	Cyrtodaria	CYRTODARIA_SP.	CYRTODARIA_SP.	HIATEFAM	2
Mollusca	Bivalvia	Myoida	Hiatellidae	Hiatella	HIATELLA_ARCTICA	SOFT_SHELL_CLAM	HIATEFAM	1
Mollusca	Bivalvia	Myoida	Myidae	Mya	MYA_ARENARIA	SOFT_SHELL_CLAM	MYIDAFAM	3
Mollusca	Bivalvia	Myoida	Myidae	Mya	MYA_TRUNCATA	MYA_TRUNCATA	MYIDAFAM	1
Mollusca	Bivalvia	Mytiloida	Mytilidae	Modiolus	MODIOLUS_MODIOLUS	HORSE_MUSSELS	MYTILFAM	223
Mollusca	Bivalvia	Mytiloida	Mytilidae	Mytilus	MYTILUS_EDULIS	COMMON_MUSSELS	MYTILFAM	3
Mollusca	Bivalvia	Mytiloida	Mytilidae	null	MYTILIDAE_F.	MUSSELS_(NS)	MYTILFAM	7
Mollusca	Bivalvia	Nuculoida	Nuculanidae	Nuculana	NUCULANA_SP.	NUCULANA_SP.	NUCULFAM	395
Mollusca	Bivalvia	Nuculoida	Nuculanidae	Nuculana	NUCULANA_TENUISULCATA	THIN_NUT_CLAM	NUCULFAM	1
Mollusca	Bivalvia	Nuculoida	Nuculanidae	null	NUCULANIDAE_F.	NUCULANIDAE_F.	NUCULFAM	121
Mollusca	Bivalvia	Nuculoida	Nuculidae	Nucula	NUCULA_SP.	NUCULA_SP.	NUCULFAM	276
Mollusca	Bivalvia	Nuculoida	Nuculidae	Nucula	NUCULA__TENUIS	NUCULA__TENUIS	NUCULFAM	7
Mollusca	Bivalvia	Nuculoida	Nuculidae	null	NUCULIDAE_F.	NUT_SHELLS	NUCULFAM	15
Mollusca	Bivalvia	Nuculoida	Yoldiidae	Yolida	YOLDIA_SAPOTILLA	YOLDIA_SAPOTILLA	YOLDIFAM	2
Mollusca	Bivalvia	Nuculoida	Yoldiidae	Yolida	YOLDIA_SP.	YOLDIA_SP.	YOLDIFAM	667
Mollusca	Bivalvia	Ostreoida	Anomiidae	Anomia	ANOMIA_SIMPLEX	ANOMIA_SIMPLEX	ANOMIFAM	2
Mollusca	Bivalvia	Ostreoida	Anomiidae	Anomia	ANOMIA_SP.	ANOMIA_SP.	ANOMIFAM	2
Mollusca	Bivalvia	Ostreoida	Anomiidae	null	ANOMIIDAE_F.	ANOMIIDAE_F.	ANOMIFAM	60
Mollusca	Bivalvia	Ostreoida	Ostreidae	Crossastrea	CRASSOSTREA_VIRGINICA	AMERICAN_CUPPED_OYSTER	OSTREFAM	1
Mollusca	Bivalvia	Ostreoida	Pectinidae	Aequipecten	AEQUIPECTEN_GLYPTUS	AEQUIPECTEN_GLYPTUS	PECTIFAM	1
Mollusca	Bivalvia	Ostreoida	Pectinidae	Chlamys	CHLAMYS_ISLANDICA	ICELAND_SCALLOP	PECTIFAM	56
Mollusca	Bivalvia	Ostreoida	Pectinidae	Placopecten	PLACOPECTEN_MAGELLANICUS	SEA_SCALLOP	PECTIFAM	118
Mollusca	Bivalvia	Ostreoida	Pectinidae	null	PECTINIDAE_F.	SCALLOPS	PECTIFAM	149
Mollusca	Bivalvia	Pholadomyoida	Cuspidariidae	Cuspidaria	CUSPIDARIA_GLACIALIS	GLACIER_DIPPER_SHELL	CUSPIFAM	16
Mollusca	Bivalvia	Pholadomyoida	Pandoridae	Pandora	PANDORA_GOULDIANA	PANDORA_GOULDIANA	PANDOFAM	8
Mollusca	Bivalvia	Solemyoida	Solemyidae	Solemya	SOLEMYA_BOREALIS	SOLEMYA_BOREALIS	SOLEMFAM	3
Mollusca	Bivalvia	Veneroida	Arcticidae	Arctica	ARCTICA_ISLANDICA	OCEAN_QUAHAUG	ARCTIFAM	1
Mollusca	Bivalvia	Veneroida	Astartidae	Astarte	ASTARTE_CASTANEA	ASTARTE_CASTANEA	ASTARFAM	1
Mollusca	Bivalvia	Veneroida	Astartidae	Astarte	ASTARTE_SP.	ASTARTE_SP.	ASTARFAM	126

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Mollusca	Bivalvia	Veneroida	Astartidae	Astarte	ASTARTE_UNDATA	ASTARTE_UNDATA	ASTARFAM	4
Mollusca	Bivalvia	Veneroida	Cardiidae	Cardium	CARDIUM_SP.	CARDIUM_SP.	CARDIFAM	358
Mollusca	Bivalvia	Veneroida	Cardiidae	Cerastoderma	CERASTODERMA_PINNULATUM	NORTHERN_DWARF_COCKLE	CARDIFAM	94
Mollusca	Bivalvia	Veneroida	Cardiidae	Clinocardium	CLINOCARDIUM_CILIATUM	ICELAND_COCKLE	CARDIFAM	116
Mollusca	Bivalvia	Veneroida	Cardiidae	null	CARDIIDAE_F.	COCKLES	CARDIFAM	278
Mollusca	Bivalvia	Veneroida	Carditidae	Venericardia	VENERICARDIA_BOREALIS	HEART_SHELL	CARDIFAM	39
Mollusca	Bivalvia	Veneroida	Mactridae	Mactromeris	MACTROMERIS_POLYNYMA	STI_SURF_CLAM	MACTRFAM	16
Mollusca	Bivalvia	Veneroida	Mactridae	Spisula	SPISULA_SOLIDISSIMA	BAR_SURF_CLAM	MACTRFAM	70
Mollusca	Bivalvia	Veneroida	Pharidae	Ensis	ENSIS_DIRECTUS	RAZOR_SHELL_CLAM	PHARIFAM	29
Mollusca	Bivalvia	Veneroida	Pharidae	Siliqua	SILIQUA_SP.	RAZOR_CLAM	PHARIFAM	2
Mollusca	Bivalvia	Veneroida	Tellinidae	Macoma	MACOMA_SP.	MACOMA_SP.	TELLIFAM	14
Mollusca	Bivalvia	Veneroida	Tellinidae	null	TELLINIDAE_F.	TELLINIDAE_F.	TELLIFAM	92
Mollusca	Bivalvia	Veneroida	Thyasiridae	Thyasira	THYASIRA_SP.	THYASIRA_SP.	THYASFAM	1
Mollusca	Bivalvia	Veneroida	Thyasiridae	null	THYASIRIDAE_F.	THYASIRIDAE_F.	THYASFAM	4
Mollusca	Bivalvia	Veneroida	Veneridae	Mercenaria	MERCENARIA_MERCENARIA	HARD_CLAM	VENERFAM	1
Mollusca	Bivalvia	Veneroida	Veneridae	Mercenaria	VENUS_MERCENARIA_(OBSOLETE)	QUAHAUG	VENERFAM	1
Mollusca	Bivalvia	null	null	null	BIVALVIA_C.	BIVALVIA_C.	BIVALVIA	2423
Mollusca	Bivalvia	null	null	null	PROTOBRANCHIA__HETERODONTA	CLAMS_(NS)	BIVALVIA	1372
Mollusca	Cephalopoda	Octopoda	Sepiolodae	null	SEPIOLODAE_F.	SEPIOLIDAE_F.	SEPIOFAM	3
Mollusca	Cephalopoda	Octopoda	null	null	OCTOPODA_O.	OCTOPUS	CEPHALOP	145
Mollusca	Cephalopoda	Octopoda	null	null	ROSSIA_HYATTI_(OBSOLETE)	ROSSIA_HYATTI	CEPHALOP	2
Mollusca	Cephalopoda	Teuthida	Ommastrephidae	Illex	ILLEX_ILLECEBROSUS	SHORT-FIN_SQUID	OMMASFAM	723
Mollusca	Cephalopoda	Teuthida	Ommastrephidae	Illex	ILLEX_SP.	ILLEX_SP.	OMMASFAM	10
Mollusca	Cephalopoda	Teuthida	Ommastrephidae	null	OMMASTREPHIDAE_F.	OMMASTREPHIDAE_F.	OMMASFAM	1
Mollusca	Cephalopoda	Teuthoidea	null	null	TEUTHOIDEA_O.	TEUTHOIDEA_O.	CEPHALOP	115
Mollusca	Cephalopoda	null	null	null	CEPHALOPODA_C.	CEPHALOPODA_C.	CEPHALOP	19
Mollusca	Cephalopoda	null	null	null	LOLIGINIDAE_OMMASTREPHIDAE_F.	SQUID_(NS)	CEPHALOP	28
Mollusca	Cephalopoda	null	null	null	SQUID_BEAKS	SQUID_BEAKS	CEPHALOP	60
Mollusca	Gastropoda	Archaeogastropoda	Calliostomatidae	Calliostoma	CALLIOSTOMA_OCCIDENTALE	CALLIOSTOMA_OCCIDENTALE	CALLIFAM	1
Mollusca	Gastropoda	Archaeogastropoda	Fissurellidae	Puncturella	PUNCTURELLA_NOACHINA	KEYHOLE_LIMPET	FISSUFAM	2
Mollusca	Gastropoda	Archaeogastropoda	Fissurellidae	null	FISSURELLIDAE_F.	KEYHOLE_LIMPID	FISSUFAM	159
Mollusca	Gastropoda	Archaeogastropoda	Trochidae	Margarites	MARGARITES_CINERA_(OBSOLETE)	MARGARITES_CINERA	TROCHFAM	9
Mollusca	Gastropoda	Archaeogastropoda	Trochidae	Margarites	MARGARITES_COSTALIS	MARGARITES_COSTALIS	TROCHFAM	3
Mollusca	Gastropoda	Archaeogastropoda	Trochidae	Margarites	MARGARITES_GROENLANDICA	M_GROENLANDICA	TROCHFAM	3
Mollusca	Gastropoda	Archaeogastropoda	Trochidae	Margarites	MARGARITES_HELICINA	MARGARITES_HELICINA	TROCHFAM	4
Mollusca	Gastropoda	Archaeogastropoda	Trochidae	null	TROCHIDAE_F.	TOP_SHELLS	TROCHFAM	45
Mollusca	Gastropoda	Archaeogastropoda	null	null	ARCHAEOGASTROPODA_O.	LIMPET_(NS)	GASTROPOD	139
Mollusca	Gastropoda	Cephalaspidea	Cylichnidae	Cylichna	CYLICHNA_ALBA	CYLICHNA_ALBA	CYLICFAM	4
Mollusca	Gastropoda	Cephalaspidea	Cylichnidae	Scaphander	SCAPHANDER_PUNCTOSTRIATUS	GIANT_CANOE_BUBBLE	CYLICFAM	19
Mollusca	Gastropoda	Gynmostomata	Clionidae	Clione	CLIONE_LIMACINA	CLIONE_LIMACINA	CLIONFAM	26
Mollusca	Gastropoda	Gynmostomata	null	null	PTEROPODA	SEA_BUTTERFLIES	GASTROPOD	35
Mollusca	Gastropoda	Heterostropha	Mathildidae	Turritellopsis	TURRITELLOPSIS_SP.	TURRITELLOPSIS_SP.	MATHIFAM	3
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Buccinum	BUCCINUM_SP.	WHELKS	BUCCIFAM	182
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Buccinum	BUCCINUM_UNDATUM	WAVE_WHELK	BUCCIFAM	2
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Colus	COLUS_SP.	SPINDLE_SHELL	BUCCIFAM	33
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Neptunea	NEPTUNEA_DECEMCOSTATA	NEW_ENGLAND_NEPTUNE	BUCCIFAM	5
Mollusca	Gastropoda	Neogastropoda	Buccinidae	null	BUCCINIDAE_EGGS	WHELK_EGGS_(NS)	INVEGGS	8
Mollusca	Gastropoda	Neogastropoda	Buccinidae	null	BUCCINIDAE_F.	BUCCINIDAE_F.	BUCCIFAM	115
Mollusca	Gastropoda	Neogastropoda	Conidae	Propebela	PROPEBELA_CANCELLATA	CANCELLATE_LORA	CONIDFAM	3
Mollusca	Gastropoda	Neogastropoda	Muricidae	Nucella	NUCELLA_LAPILLUS	NUCELLA_LAPILLUS	MURICFAM	1

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Mollusca	Gastropoda	Neogastropoda	Nassariidae	Ilyanassa	ILYANASSA_OBSOLETA	MUD_SNAIL	NASSAFAM	2
Mollusca	Gastropoda	Neotaenioglossa	Aporrhaididae	Aporrhais	APORRHAIS_SP.	DUCK_OR_PELICAN_FOOT	APORRFAM	6
Mollusca	Gastropoda	Neotaenioglossa	Carinariidae	null	HETEROPODA	PELAGIC_SEA_SNAIL	CARINFAM	1
Mollusca	Gastropoda	Neotaenioglossa	Carinariidae	null	HETEROPODA	PTEROPODA	CARINFAM	8
Mollusca	Gastropoda	Neotaenioglossa	Epitoniidae	Epitonium	EPITONIUM_SP.	EPITONIUM	EPITOFAM	2
Mollusca	Gastropoda	Neotaenioglossa	Littorinidae	null	LITTORINIDAE_F.	PERIWINKLES	LITTOFAM	40
Mollusca	Gastropoda	Neotaenioglossa	Naticidae	Amauropsis	AMAUROPSIS_ISLANDICA	AMAUROPSIS_ISLANDICA	NATICFAM	1
Mollusca	Gastropoda	Neotaenioglossa	Naticidae	Euspira	EUSPIRA_HEROS	NORTHERN_MOONSNAIL	NATICFAM	111
Mollusca	Gastropoda	Neotaenioglossa	Naticidae	Natica	NATICA_CLAUSA	LITTLE_MOONSHELL	NATICFAM	6
Mollusca	Gastropoda	Neotaenioglossa	Skeneopsidae	Skeneopsis	SKENEOPSIS_SP.	SKENES	SKENEFAM	2
Mollusca	Gastropoda	Neotaenioglossa	Velutinidae	Velutina	VELUTINA_LAEVIGATA	VELVET_SHELL	VELUTFAM	7
Mollusca	Gastropoda	Nudibranchia	null	null	NUDIBRANCHIA_O.	SEA_SLUGS	GASTROPOD	15
Mollusca	Gastropoda	Thecostomata	Limacinisdae	Limacina	LIMACINA_SP.	LIMACINA_SP.	LIMAFAM	3
Mollusca	Gastropoda	Thecostomata	null	null	THECOSOMATA_O.	THECOSOMATA_O.	GASTROP	1
Mollusca	Gastropoda	null	null	null	GASTROPODA_O.	SNAILS_AND_SLUGS	SCAPHOP	1991
Mollusca	Polyplacophora	Neoloricata	Ischnochitonidae	Ischnochiton	ISCHNOCHITON_SP.	ISCHNOCHITON_SP.	ISCHNFAM	1
Mollusca	Polyplacophora	Neoloricata	Ischnochitonidae	Tonicella	TONICELLA_RUBRA	RED_NORTHERN_CHITON	ISCHNFAM	1
Mollusca	Polyplacophora	Neoloricata	Leptochitonidae	Lepidopleurus	LEPIDOPLEURUS_CANCELLATUS	ARCTIC_CANCELLATE_CHITON	LEPTOFAM	2
Mollusca	Polyplacophora	Neoloricata	Mopaliidae	Amicula	AMICULA_VESTITA	AMICULA_VESTITA	MOPALFAM	58
Mollusca	Polyplacophora	null	null	null	POLYPLACOPHORA_C	CHITONS	POLYPLAC	405
Mollusca	Scaphopoda	null	null	null	SCAPHOPODA_C.	TUSK_OR_TOOTHSHELLS	SCAPHOP	162
Mollusca	null	null	null	null	CEPHALOPODA_UNID._EGGS	SQUID_EGGS	INVEGGS	2
Mollusca	null	null	null	null	GASTEROPODA_EGGS	SNAIL/SLUG_EGGS	INVEGGS	8
Mollusca	null	null	null	null	MOLLUSCA_EGGS	MOLLUSC_EGGS_UNID.	INVEGGS	3
Mollusca	null	null	null	null	MOLLUSCA_P.	MOLLUSCA_P.	MOLLUSC	880
Mollusca	null	null	null	null	MOLLUSC_REMAINS	MOLLUSC_REMAINS	MOLLUSC	390
Mollusca	null	null	null	null	OPERCULUM	OPERCULUM	MOLLUSC	63
Mollusca	null	null	null	null	null	null	MOLLUSC	24
Nemata	Nematoda	null	null	null	COD_WORM	COD_WORM	PARASITE	333
Nemata	Nematoda	null	null	null	NEMATODA_C	NEMATODA_C	PARASITE	734
Nemata	Nematoda	null	null	null	NEMATODA_EGGS	TUBE_WORMS_EGGS_UNID.	INVEGGS	2
Nemata	Secernentea	Ascaridida	Toxocaridae	Porrocaecum	PORROCAECUM_DECIPIENS	PORROCAECUM_DECIPIENS	PARASITE	2
Nemata	Secernentea	Ascaridida	Toxocaridae	Porrocaecum	PORROCAECUM_SP.	PORROCAECUM_SP.	PARASITE	1
Nemata	null	null	null	null	PARASITES_ROUND_WORMS	PARASITES_ROUND_WORMS	PARASITE	10
Platyhelminthes	Cestoda	null	null	null	CESTODA_C.	CESTODA_C	PARASITE	88
Platyhelminthes	Trematoda	null	null	null	TREMATODA_C.	TREMATODA_C.	PARASITE	207
Platyhelminthes	Turbellaria	null	null	null	TURBELLARIA_C.	TURBELLARIA_C.	PARASITE	1
Platyhelminthes	null	null	null	null	null	null	OTHER	6
Porifera	Demospongiae	Haplosclerida	Chalinidae	Haliclona	HALICLONA_SP.	HALICLONA_SP.	CHALIFAM	1
Porifera	null	null	null	null	PORIFERA_P.	SPONGES	PORIFERA	71
Priapula	null	null	Priapulidae	Priapulus	PRIAPULUS_CAUDATUS	PRIAPULUS	PRIAPFAM	7
Protozoa	Granuloreticulosa	Foraminiferida	Allogromiidae	Allogromia	ALLOGROMIA_SP.	ALLOGROMIA_SP.	ALLOFAM	3
Rhodophyta	Rhodophyceae	null	null	null	RHODOPHYCEAE	RED_SEAWEEDS	SEAWEED	9
Rhynchocoela	null	null	null	null	RHYNCHOCOELA_P.	RHYNCHOCOELA_P.	OTHER	88
Sipuncula	null	null	Golfingia	Phascolion	PHASCOLION_STROMBI	PHASCOLION_STROMBI	GOLFIFAM	6
Sipuncula	null	null	null	null	GEPHYREA_(SIPUNCULA)_P.	GEPHYREA_(SIPUNCULA)	ANNELIDA	174
Sipuncula	null	null	null	null	SIPUNCULUS_SP.	SIPUNCULUS_SP.	SIPUNFAM	2
Unid	null	null	null	null	BAIT	BAIT	OTHER	23
Unid	null	null	null	null	BAIT__HERRING	BAIT__HERRING	OTHER	57
Unid	null	null	null	null	BAIT__MACKEREL	BAIT__MACKEREL	OTHER	653

Phylum	Class	Order	Family	Genus	Species	Common	Fam group	N in SDSTO
Unid	null	null	null	null	BAIT__REDFISH	BAIT__REDFISH	OTHER	1
Unid	null	null	null	null	BAIT__SQUID	BAIT__SQUID	OTHER	164
Unid	null	null	null	null	FLUID	FLUID	OTHER	520
Unid	null	null	null	null	GARBAGE	GARBAGE	OTHER	19
Unid	null	null	null	null	INORGANIC_DEBRIS	INORGANIC_DEBRIS	OTHER	76
Unid	null	null	null	null	INVERTEBRATE_EGGS	INVERTEBRATE_EGGS	INVEGGS	2
Unid	null	null	null	null	MARINE_INVERTEBRATA_(NS)	MARINE_INVER_(NS)	OTHER_INV	20
Unid	null	null	null	null	MUCUS	MUCUS	OTHER	5620
Unid	null	null	null	null	MUD	MUD	OTHER	37
Unid	null	null	null	null	ORGANIC_DEBRIS	ORGANIC_DEBRIS	OTHER	6994
Unid	null	null	null	null	SAND	SAND	OTHER	58
Unid	null	null	null	null	SAND_TUBE	SAND_TUBE	OTHER	123
Unid	null	null	null	null	SCALLOP_VISCERA	SCALLOP_VISCERA	PECTIFAM	54
Unid	null	null	null	null	STONES_AND_ROCKS	STONES_AND_ROCKS	OTHER	1717
Unid	null	null	null	null	THALLOPHYTA_C.	SEAWEED_(ALGAE)_KELP	SEAWEED	787
Unid	null	null	null	null	UNID_FISH_AND_INVERTEBRATES	UNID_FISH_AND_INVER	OTHER	172
Unid	null	null	null	null	UNID_REMAINS_DIGESTED	UNID_REMAINS_DIGESTED	OTHER	12894
Unid	null	null	null	null	WATER	WATER	OTHER	28
Unid	null	null	null	null	null	null	OTHER	137

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Appendix 3-GS: Species accumulation curves

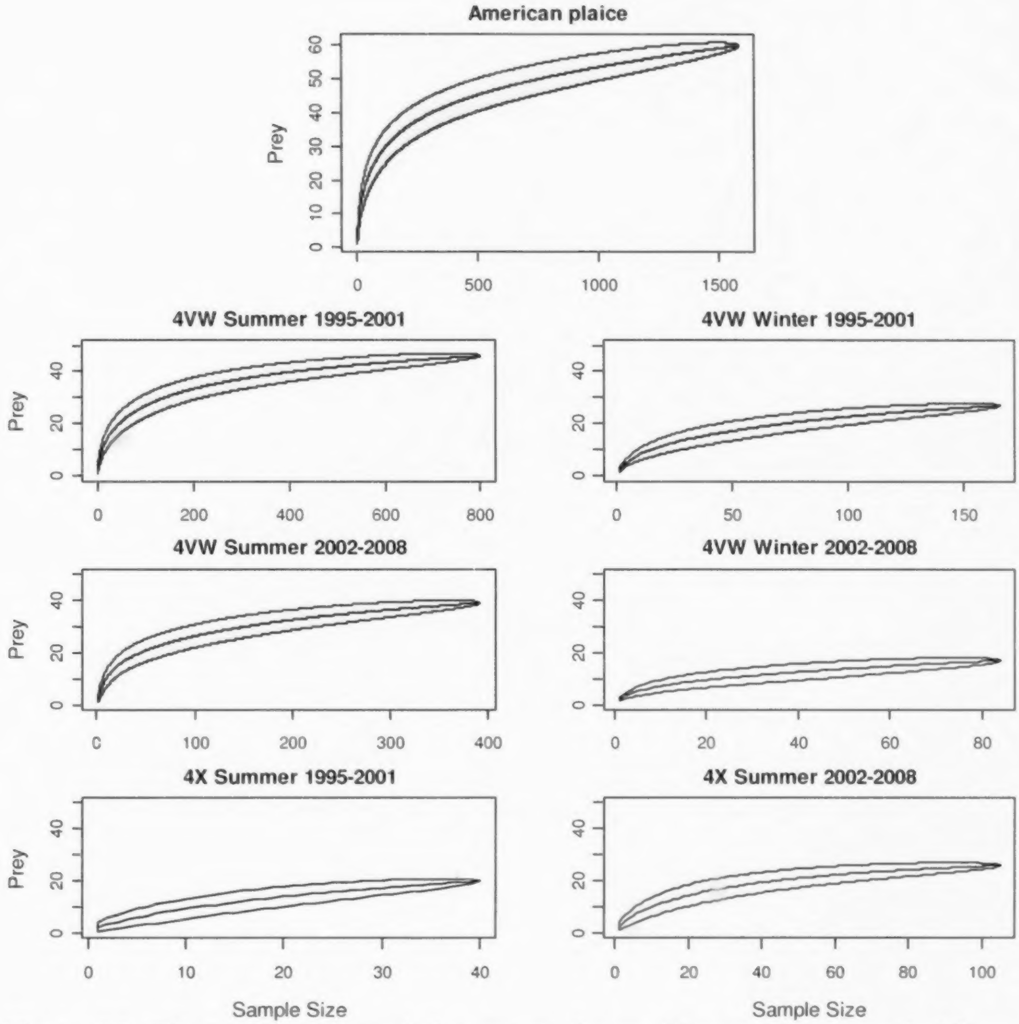
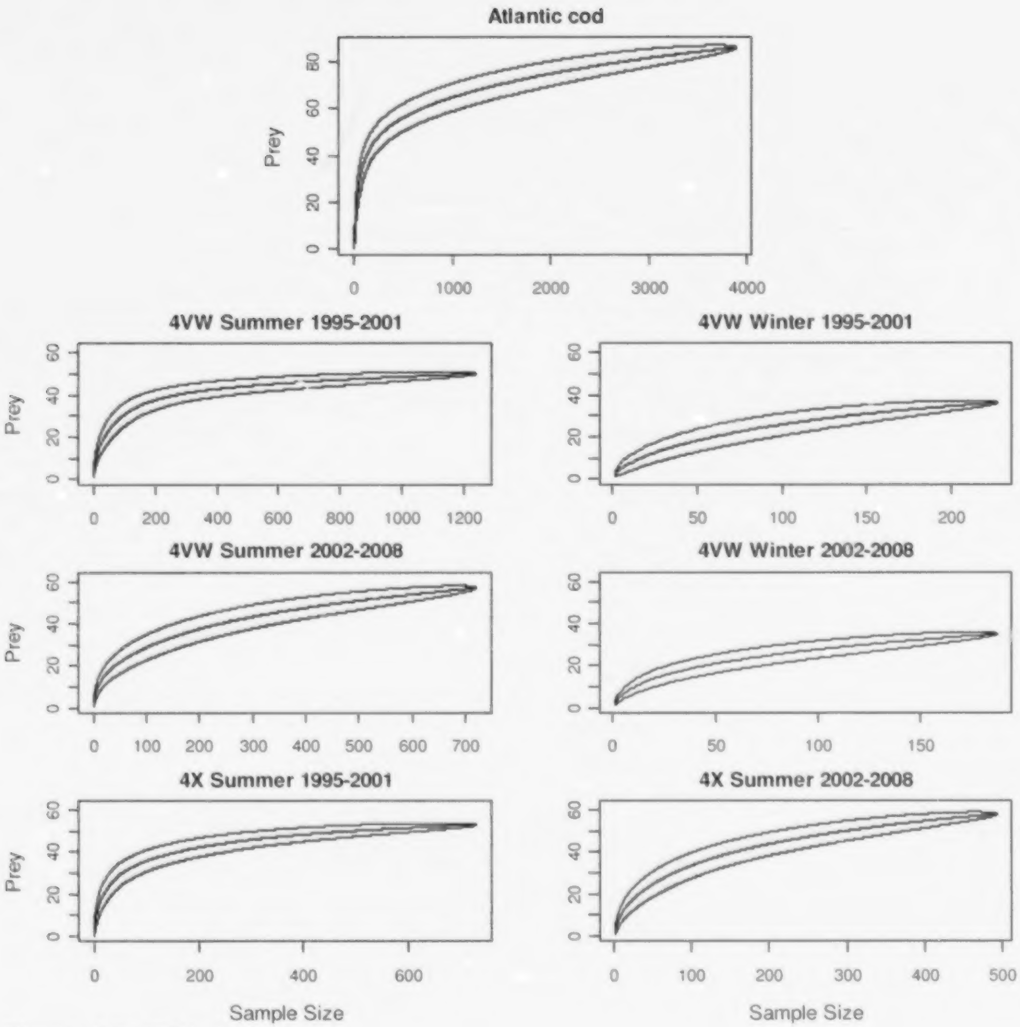


Figure A3: GS species accumulation curves for predator species sampled from the Groundfish Surveys. Green shading indicates curves with minimum change at the asymptote =<0.05.


Atlantic cod

4VW Summer 1995-2001

4VW Winter 1995-2001

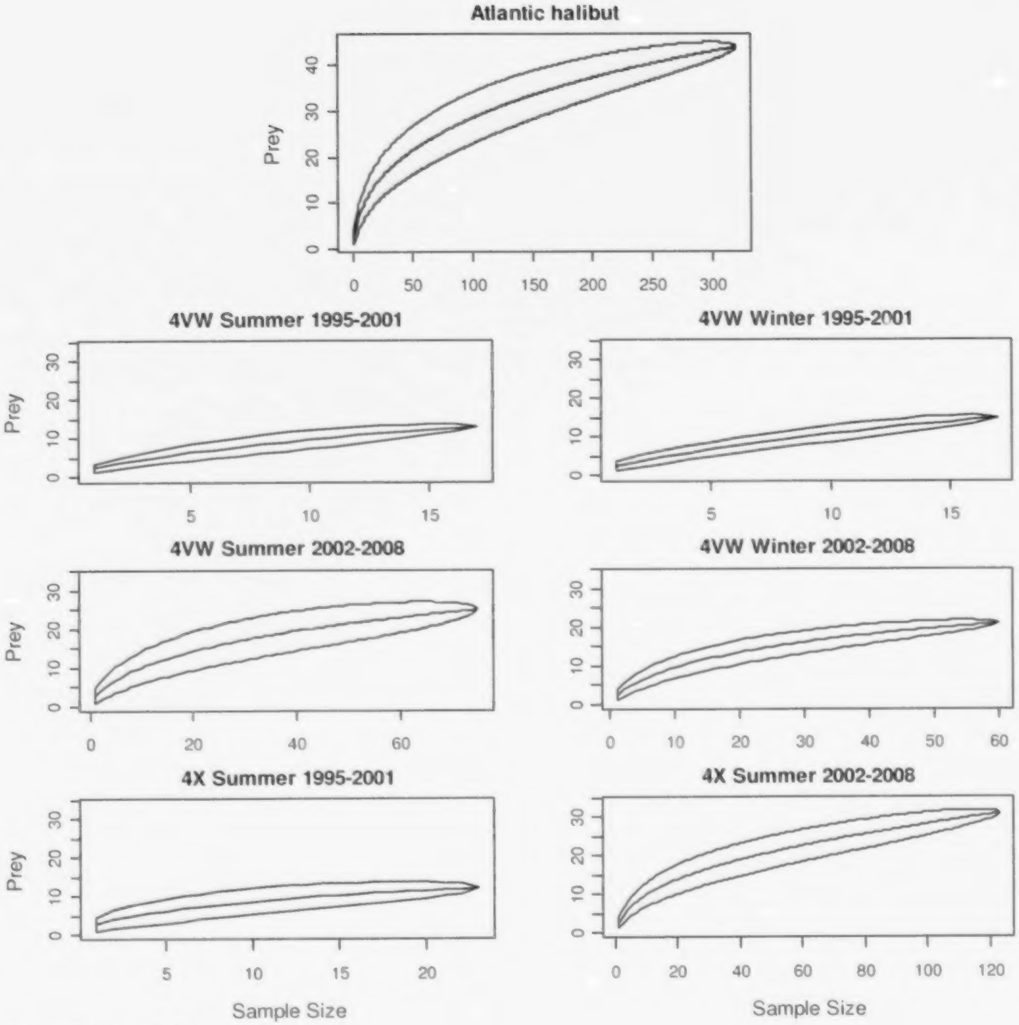
4VW Summer 2002-2008

4VW Winter 2002-2008

4X Summer 1995-2001

4X Summer 2002-2008

Figure A3- GS(cont)



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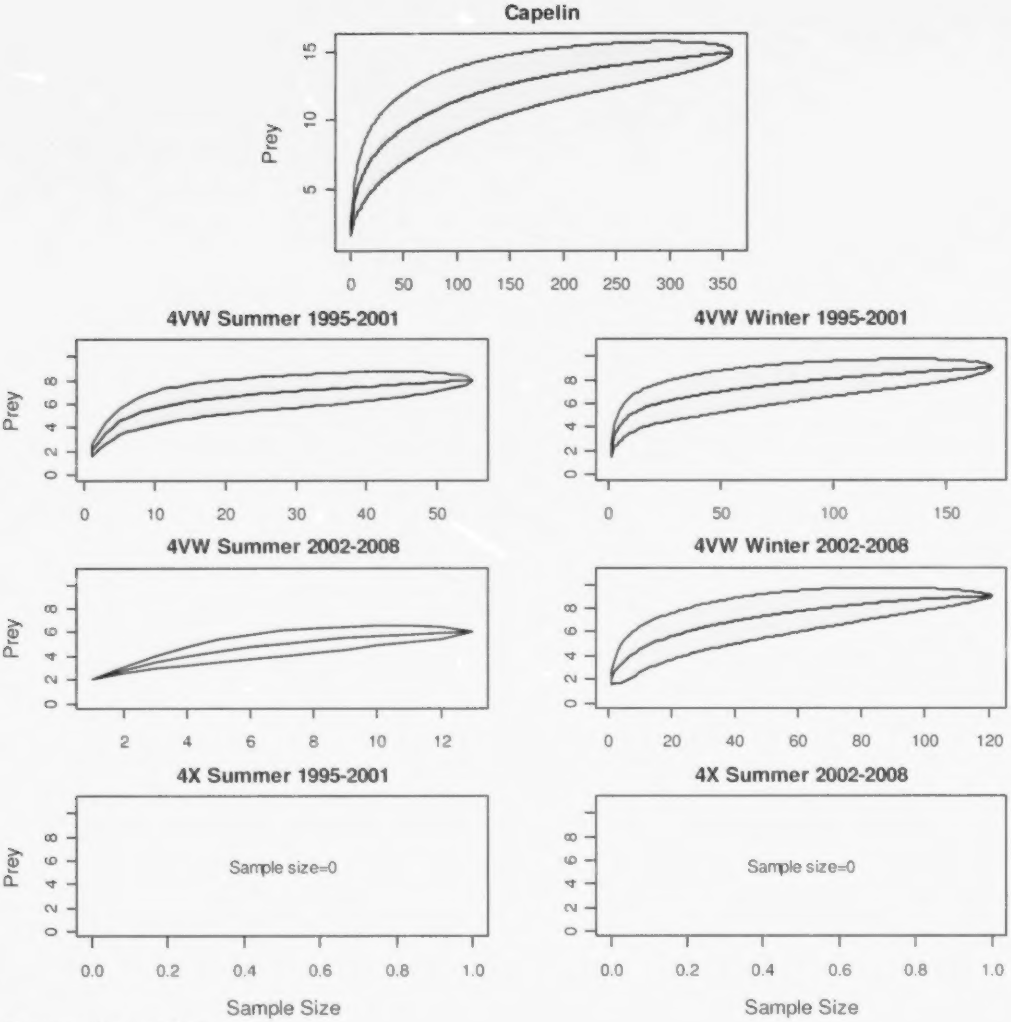

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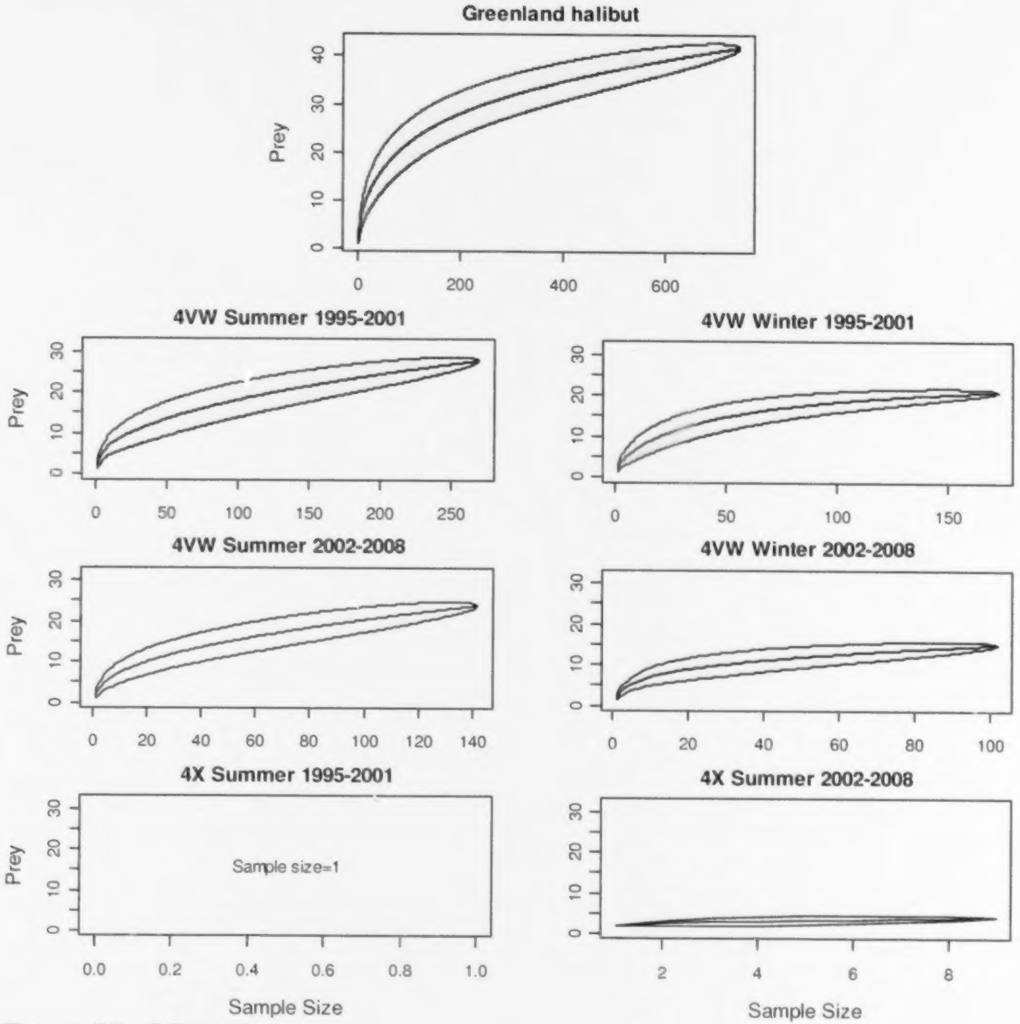

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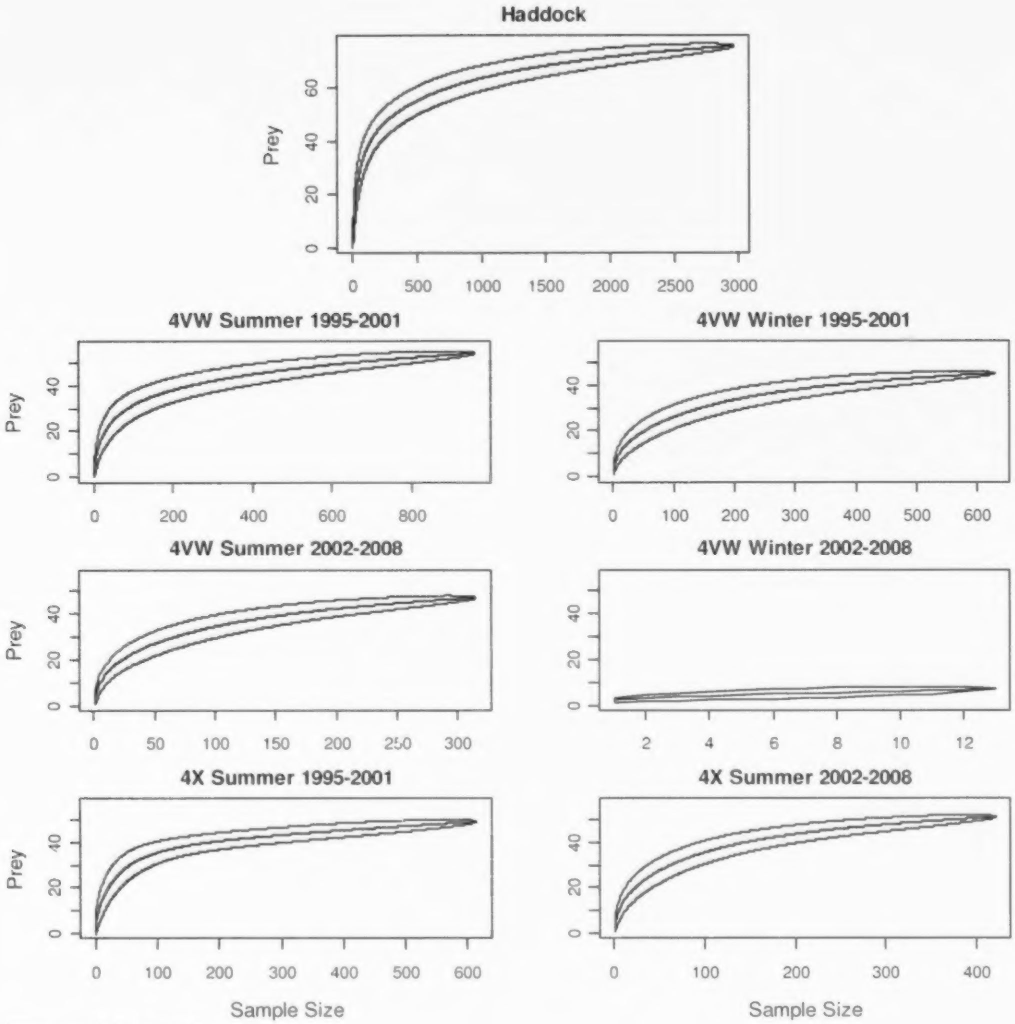

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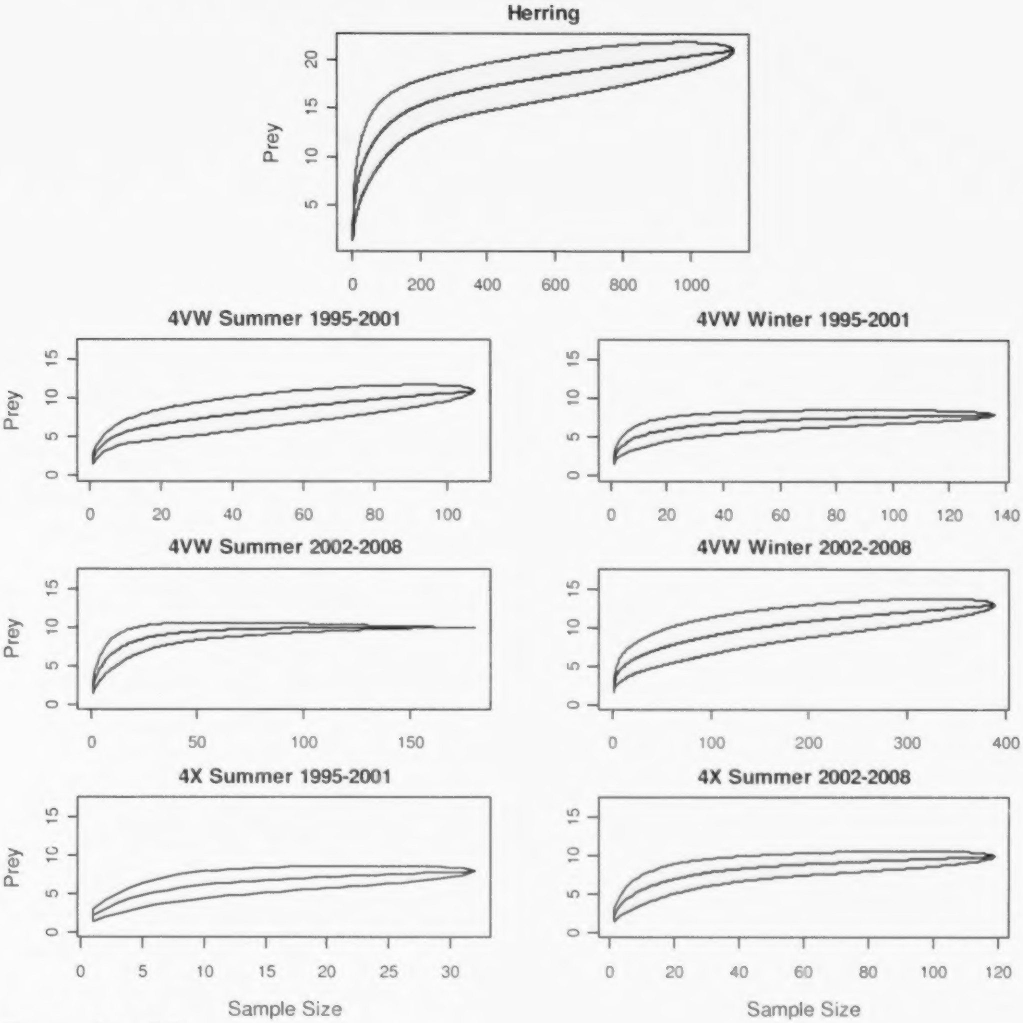
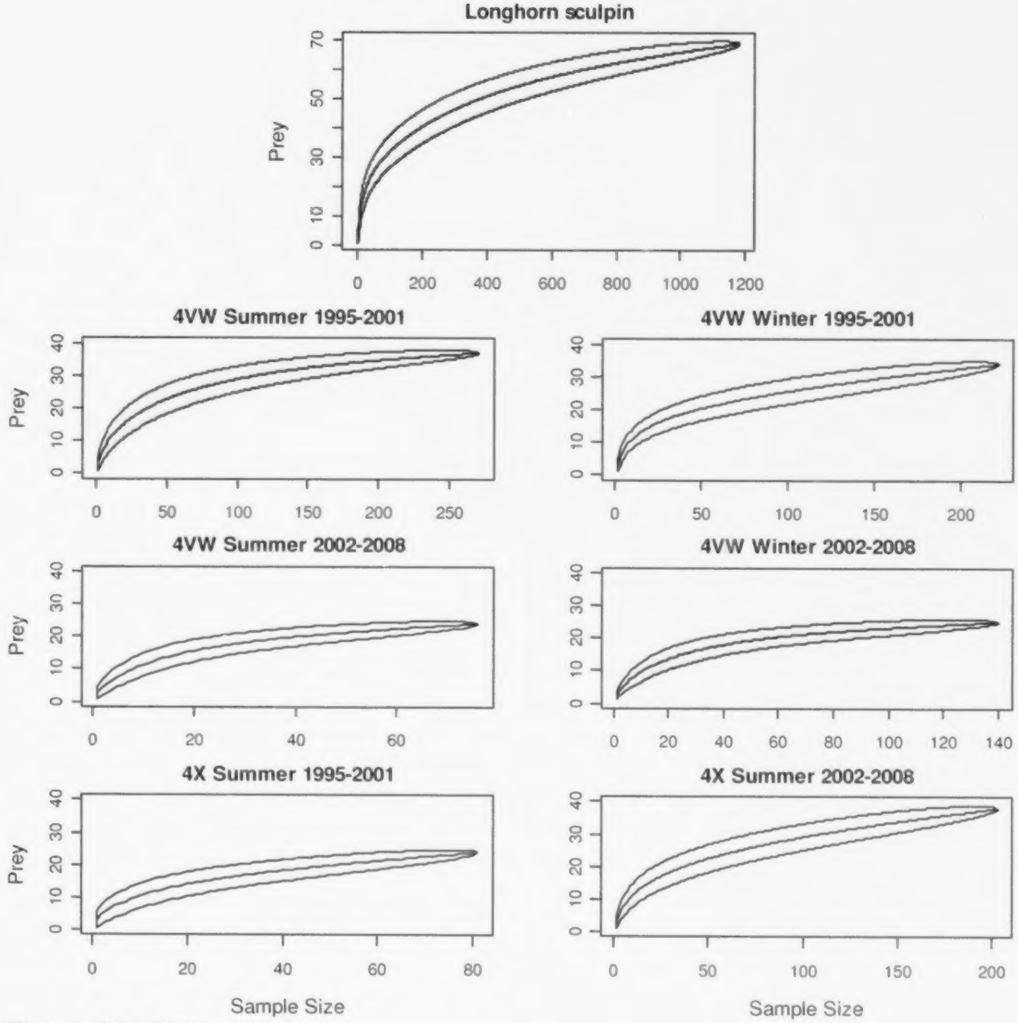


Figure A3- GS(cont)



Longhorn sculpin

4VW Summer 1995-2001

4VW Winter 1995-2001

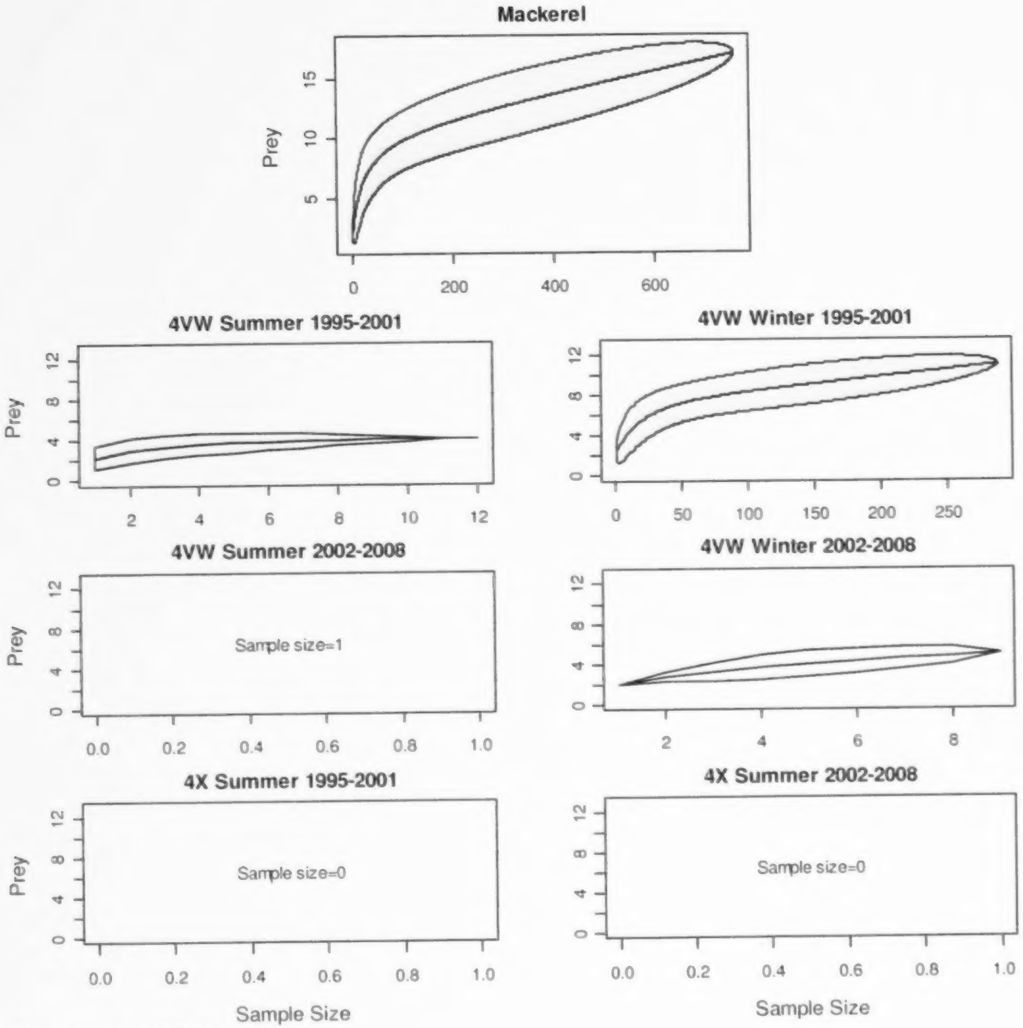
4VW Summer 2002-2008

4VW Winter 2002-2008

4X Summer 1995-2001

4X Summer 2002-2008

Figure A3- GS(cont)



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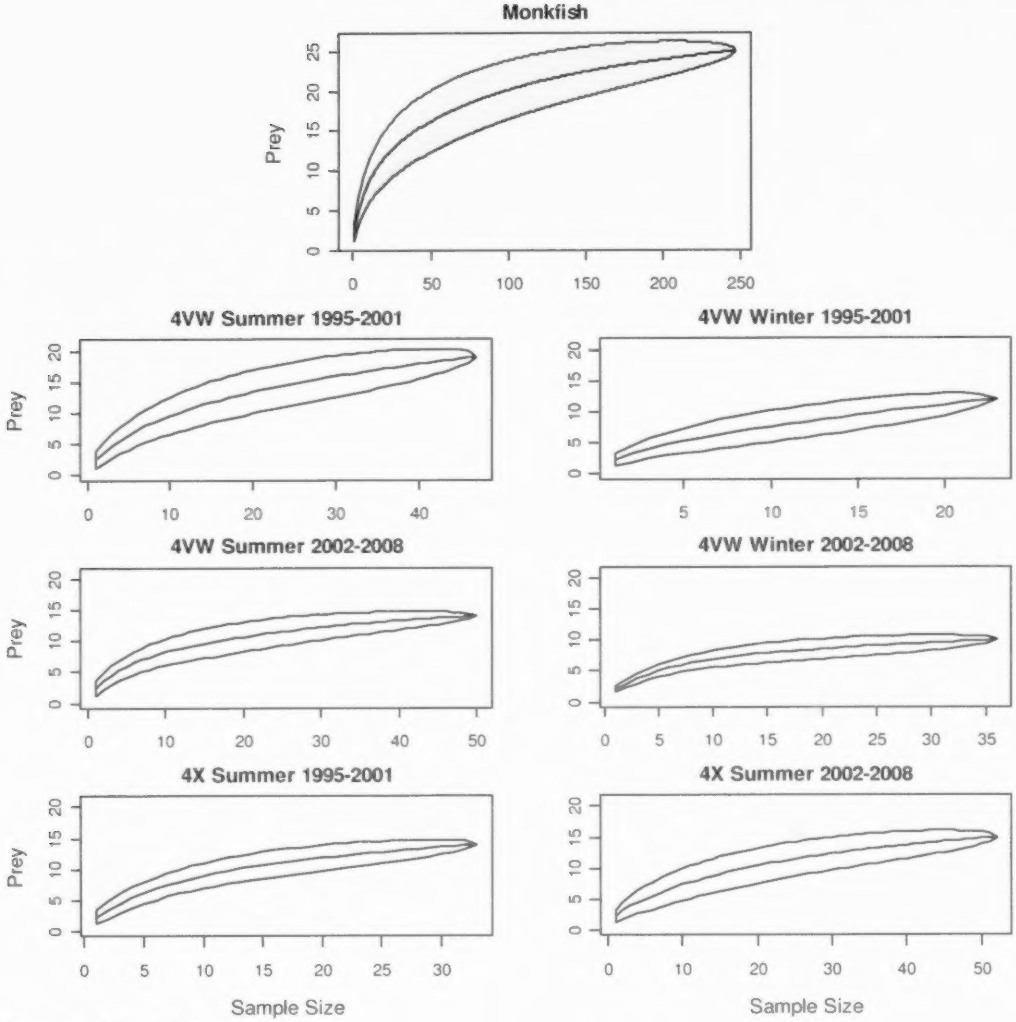

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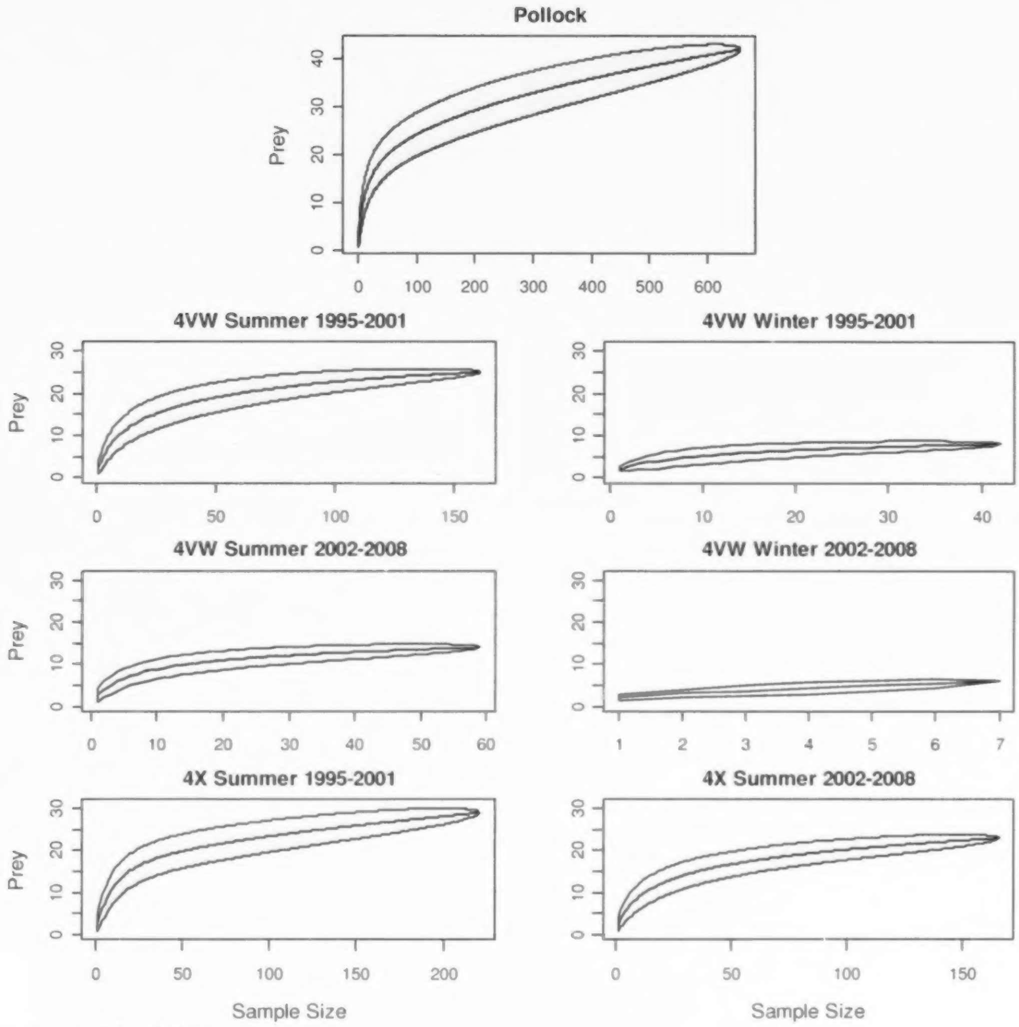

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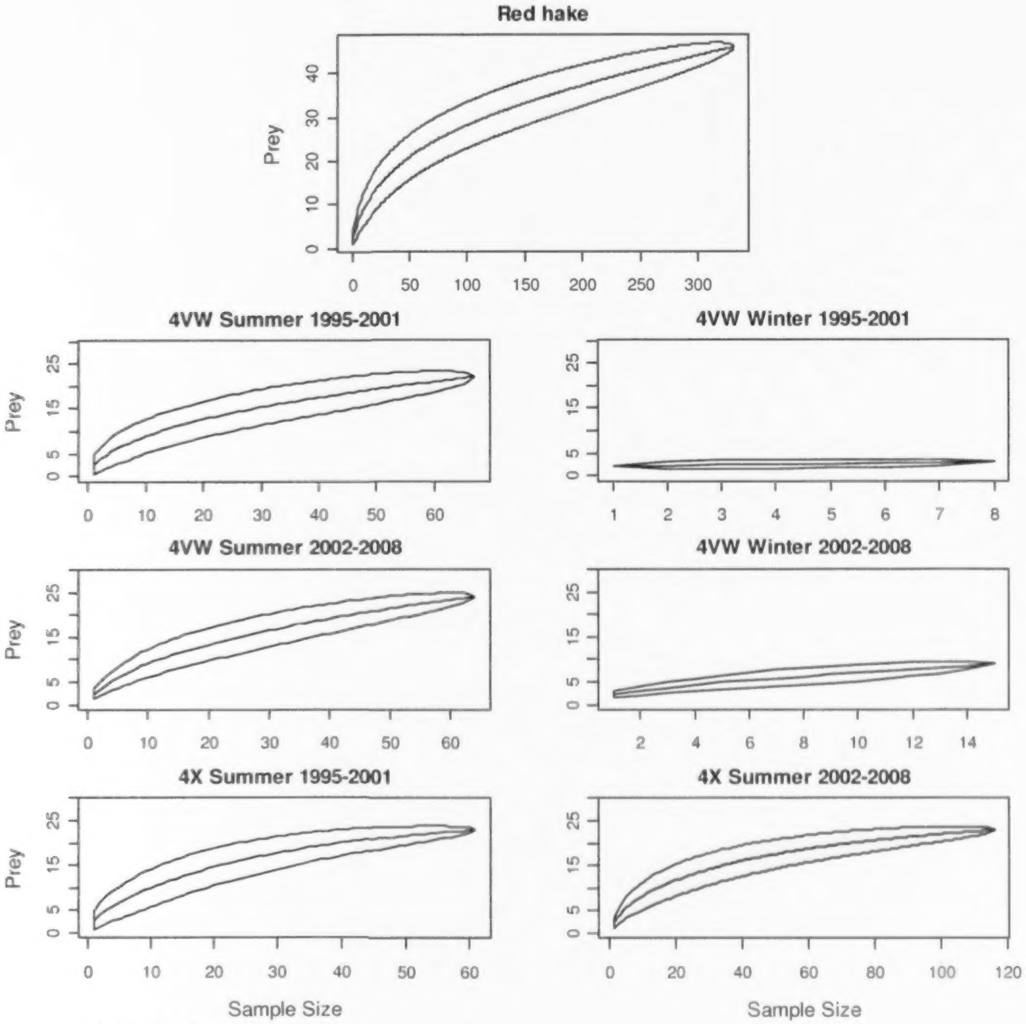

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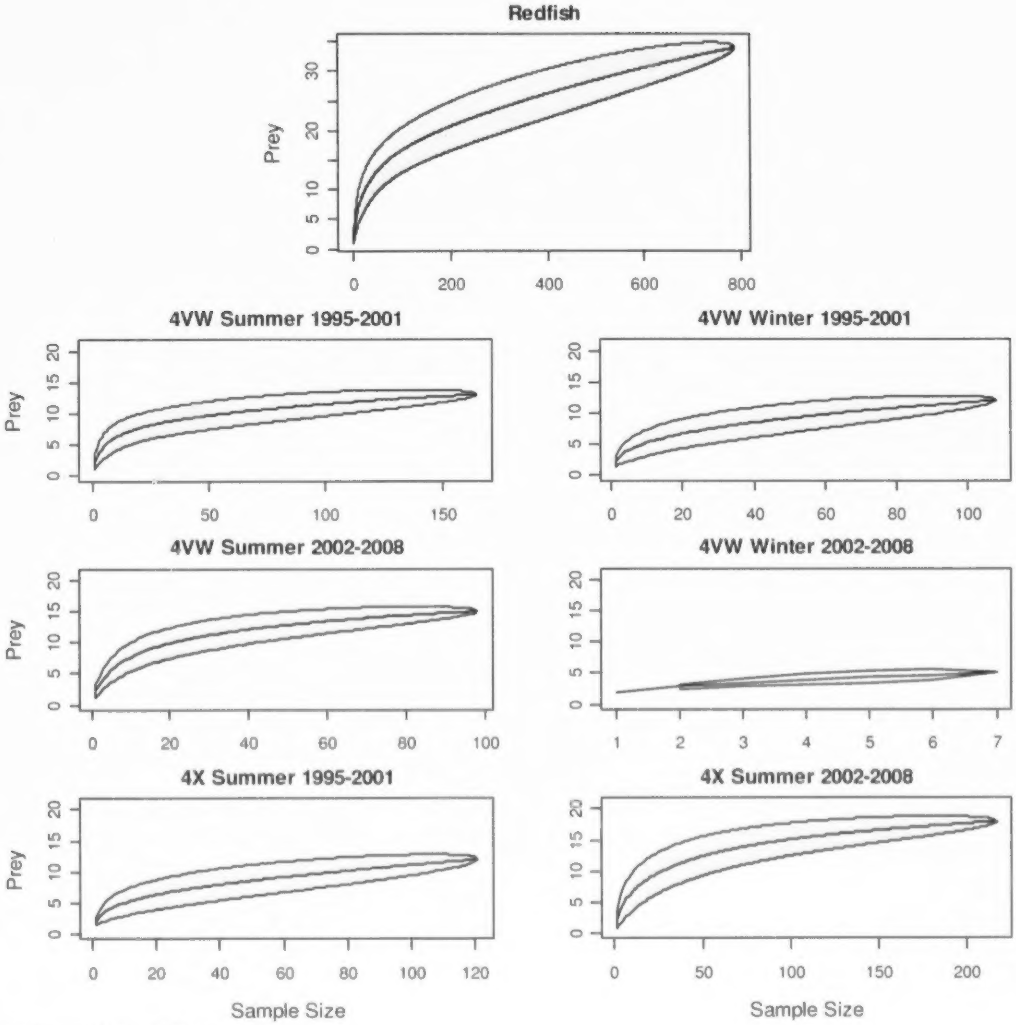

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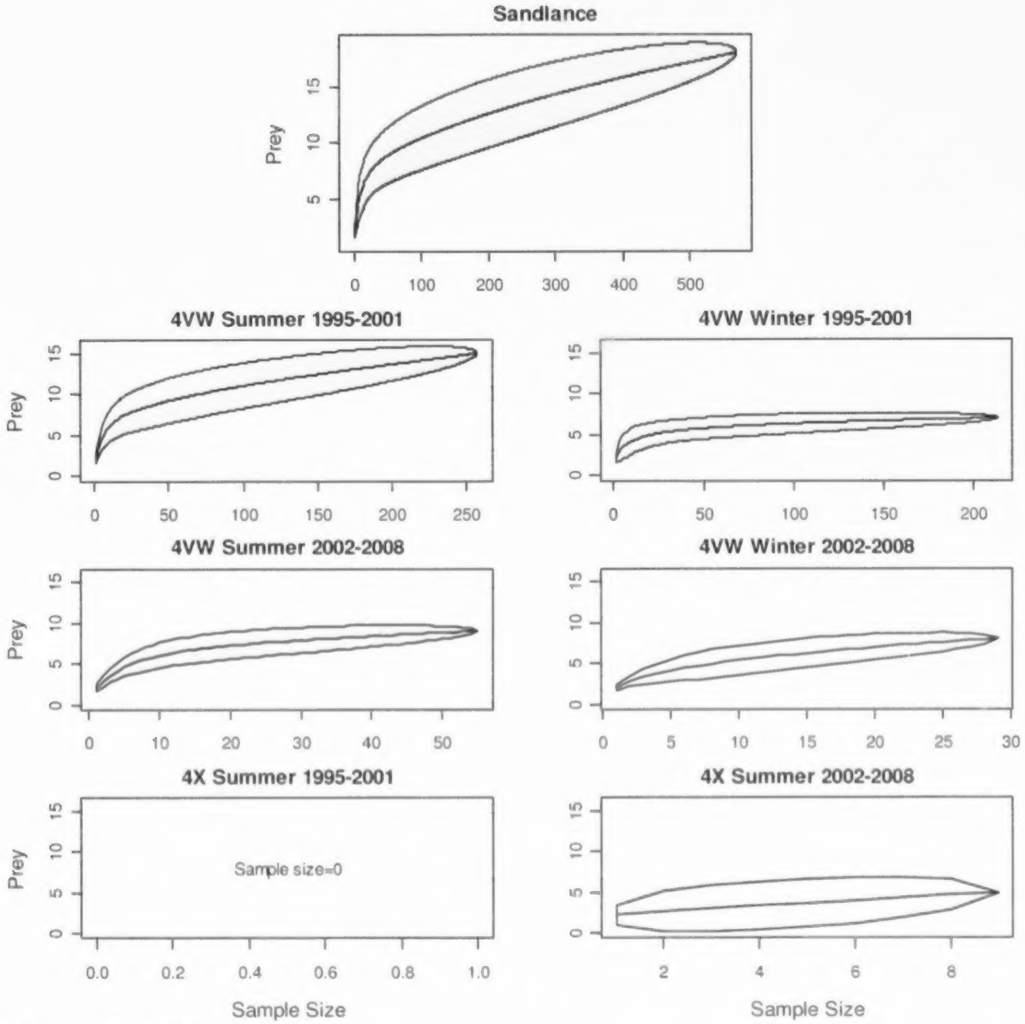

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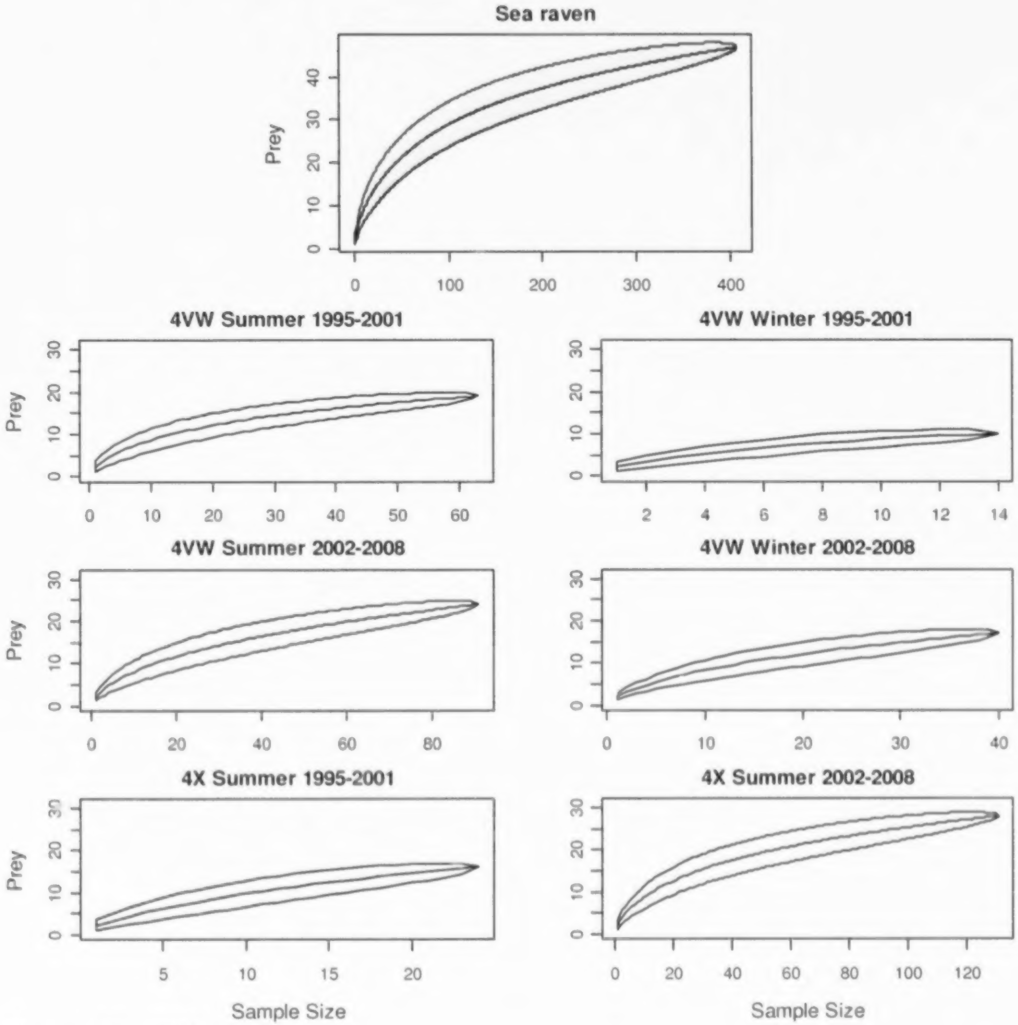

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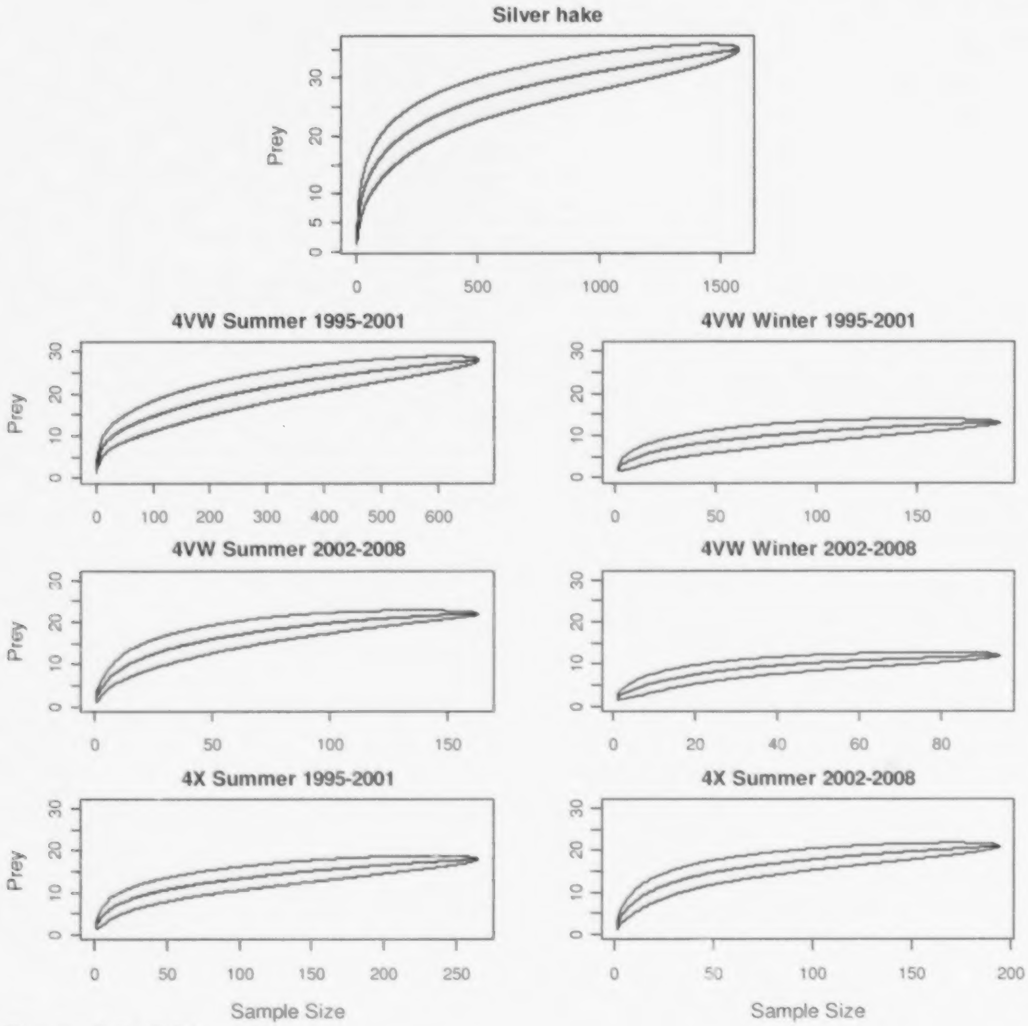


Figure A3- GS(cont)

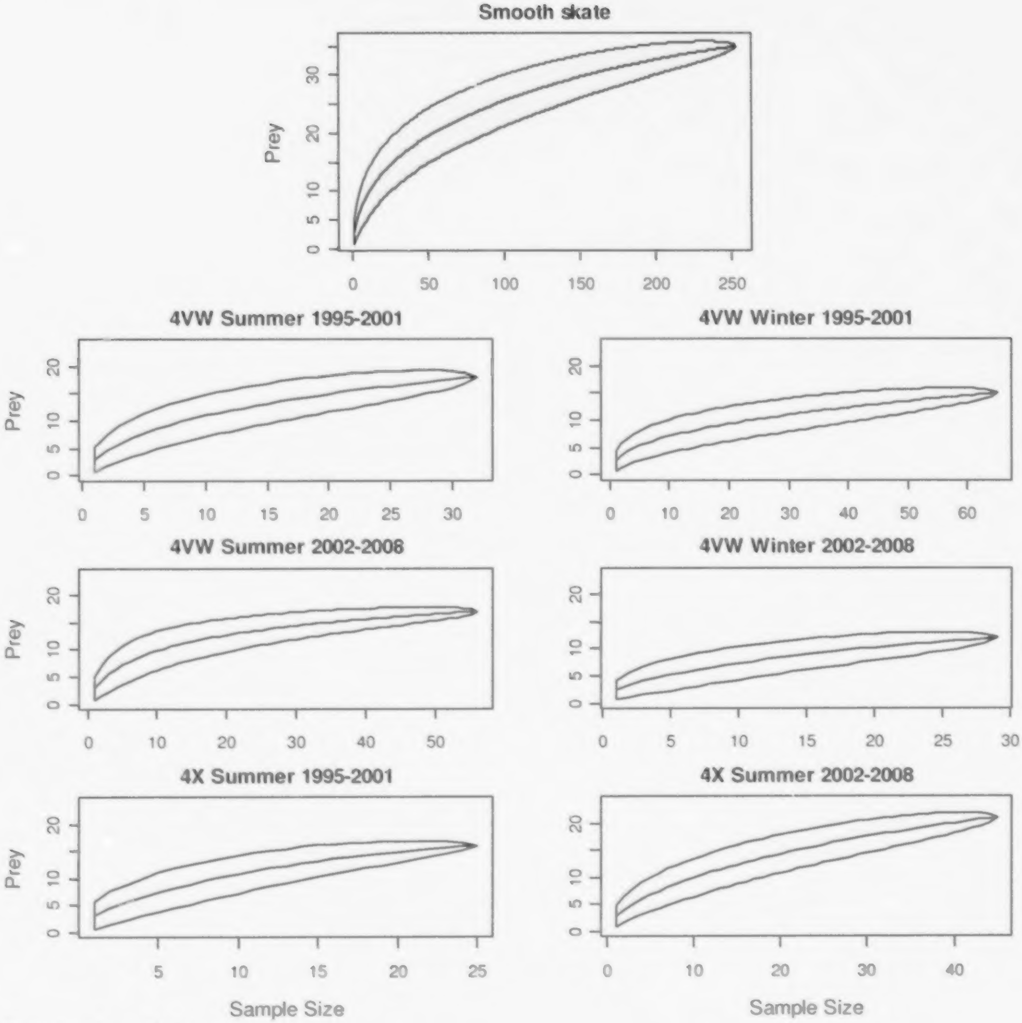


Figure A3- GS(cont)

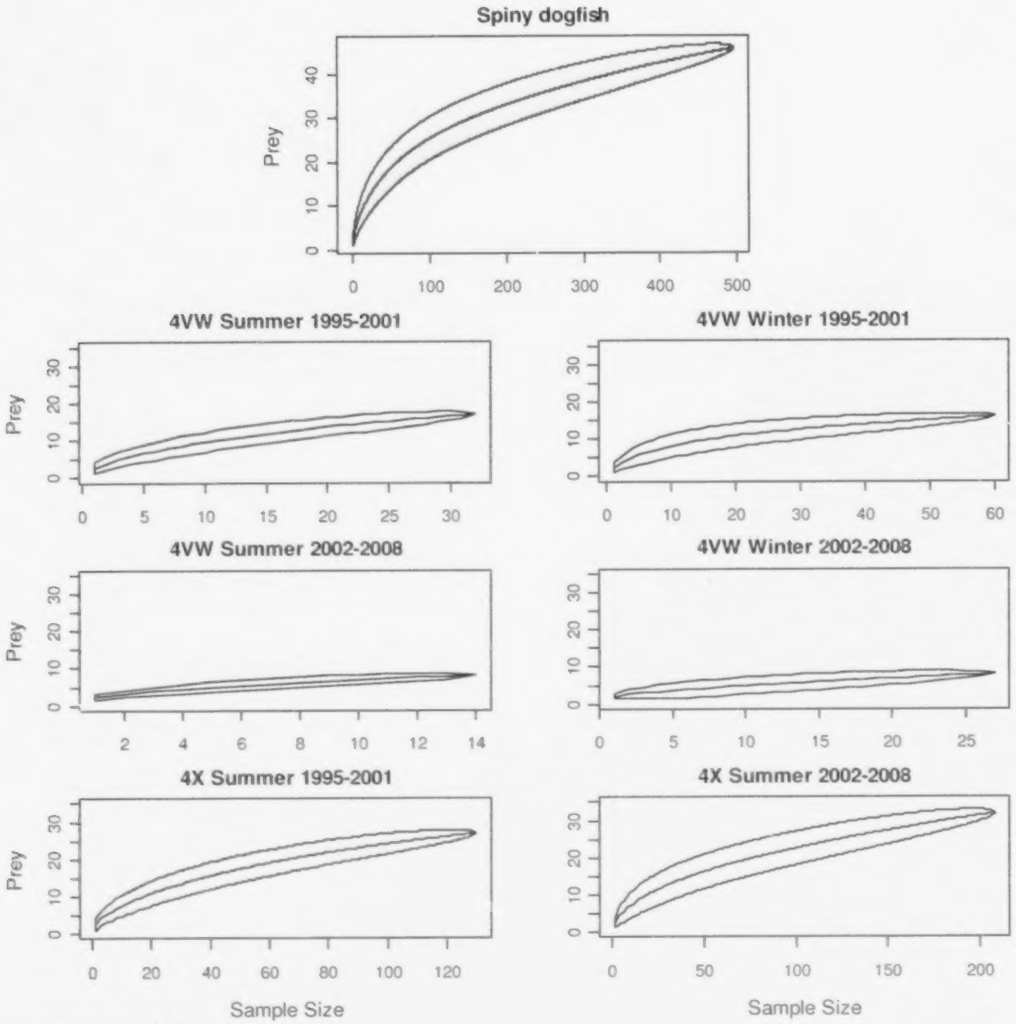


Figure A3- GS(cont)

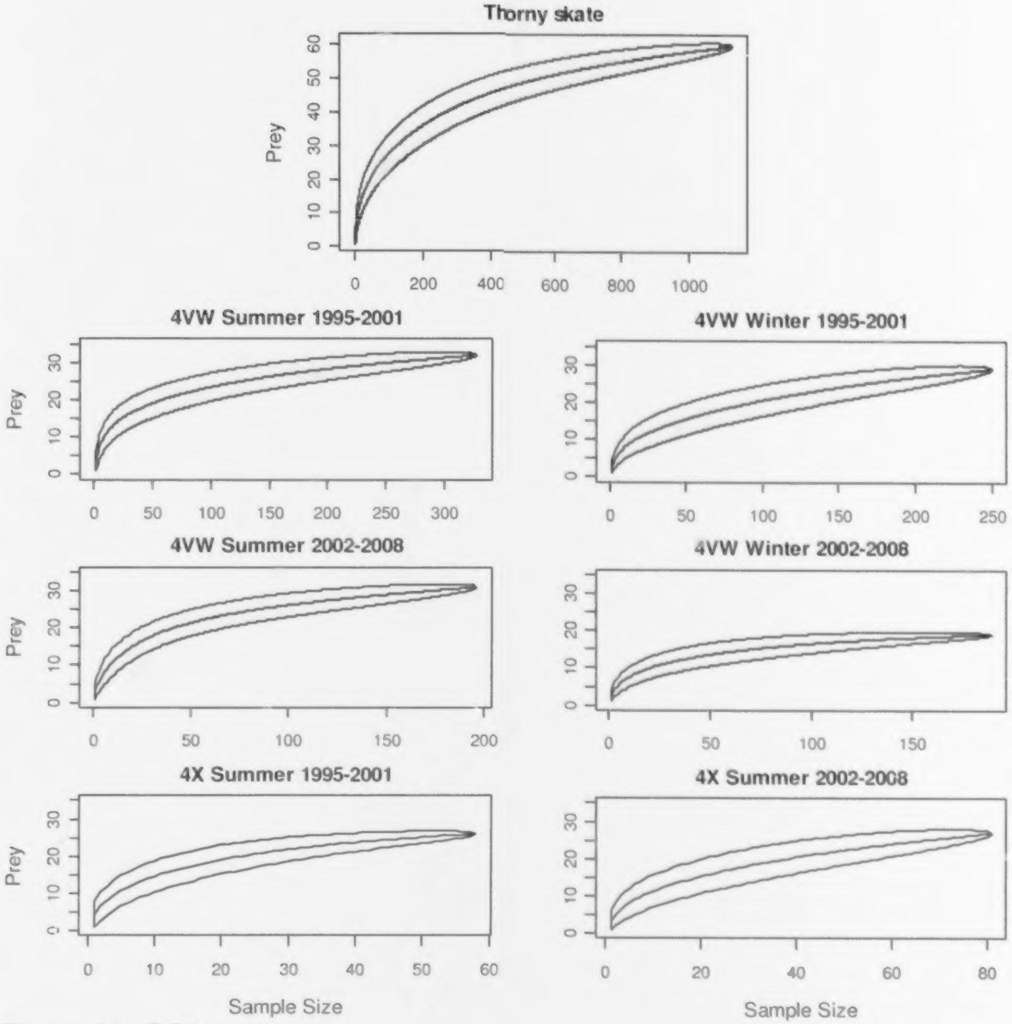
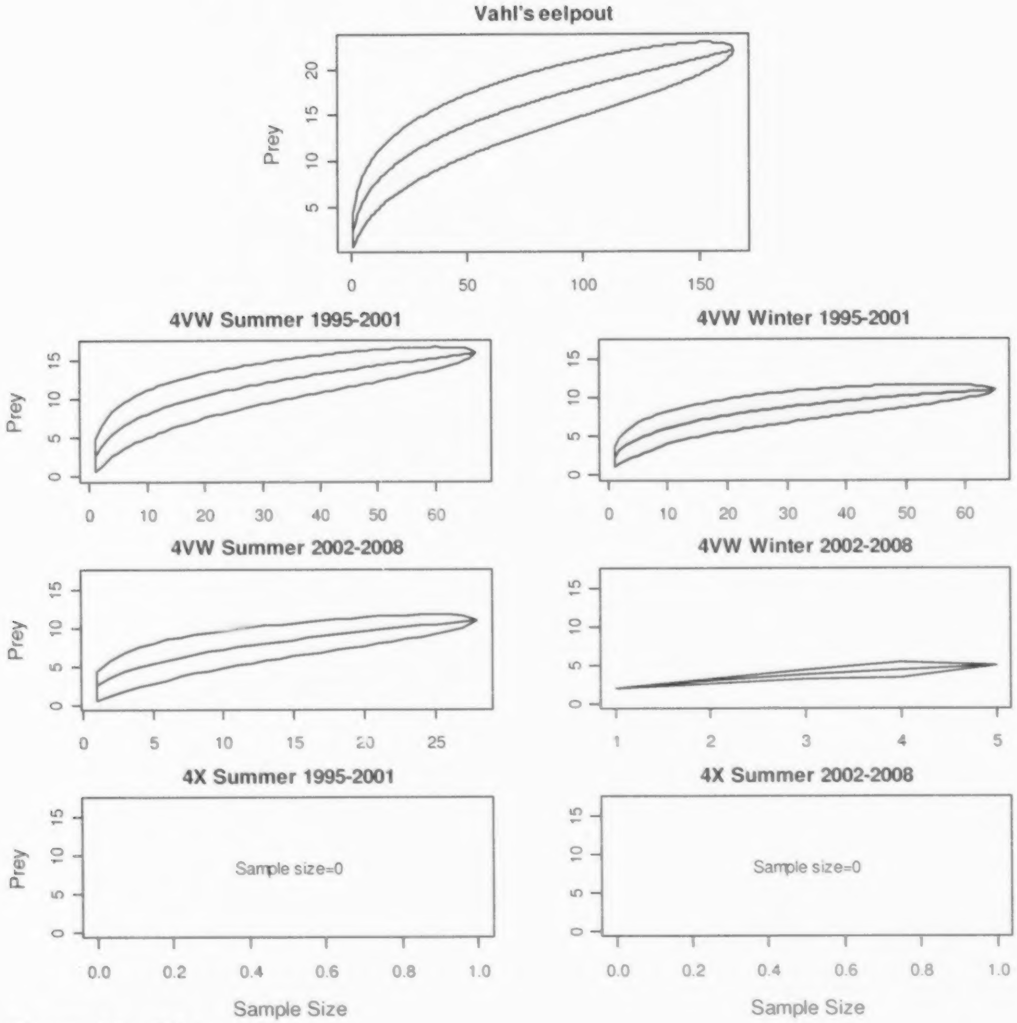


Figure A3- GS(cont)



Vahl's eelpout

4VW Summer 1995-2001

4VW Winter 1995-2001

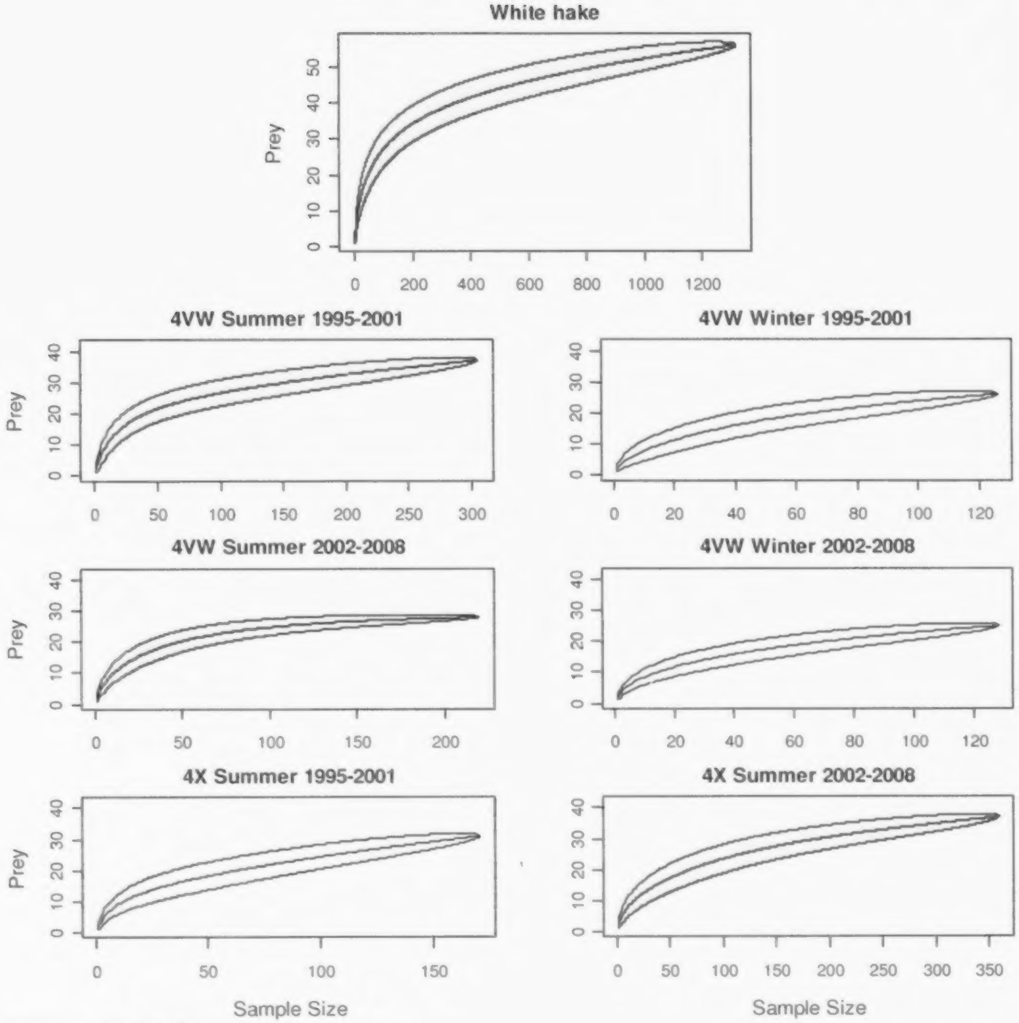
4VW Summer 2002-2008

4VW Winter 2002-2008

4X Summer 1995-2001

4X Summer 2002-2008

Figure A3- GS(cont))


White hake

4VW Summer 1995-2001

4VW Winter 1995-2001

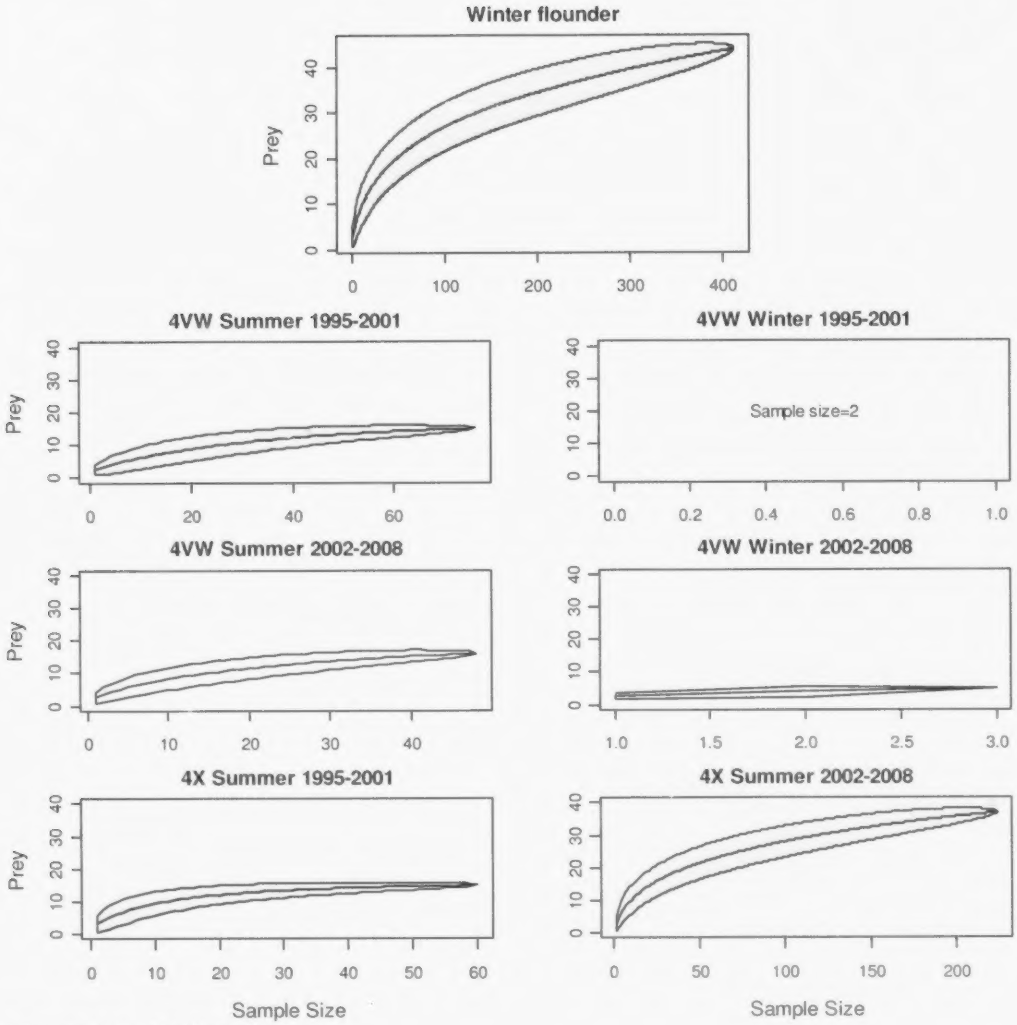
4VW Summer 2002-2008

4VW Winter 2002-2008

4X Summer 1995-2001

4X Summer 2002-2008

Figure A3- GS(cont)



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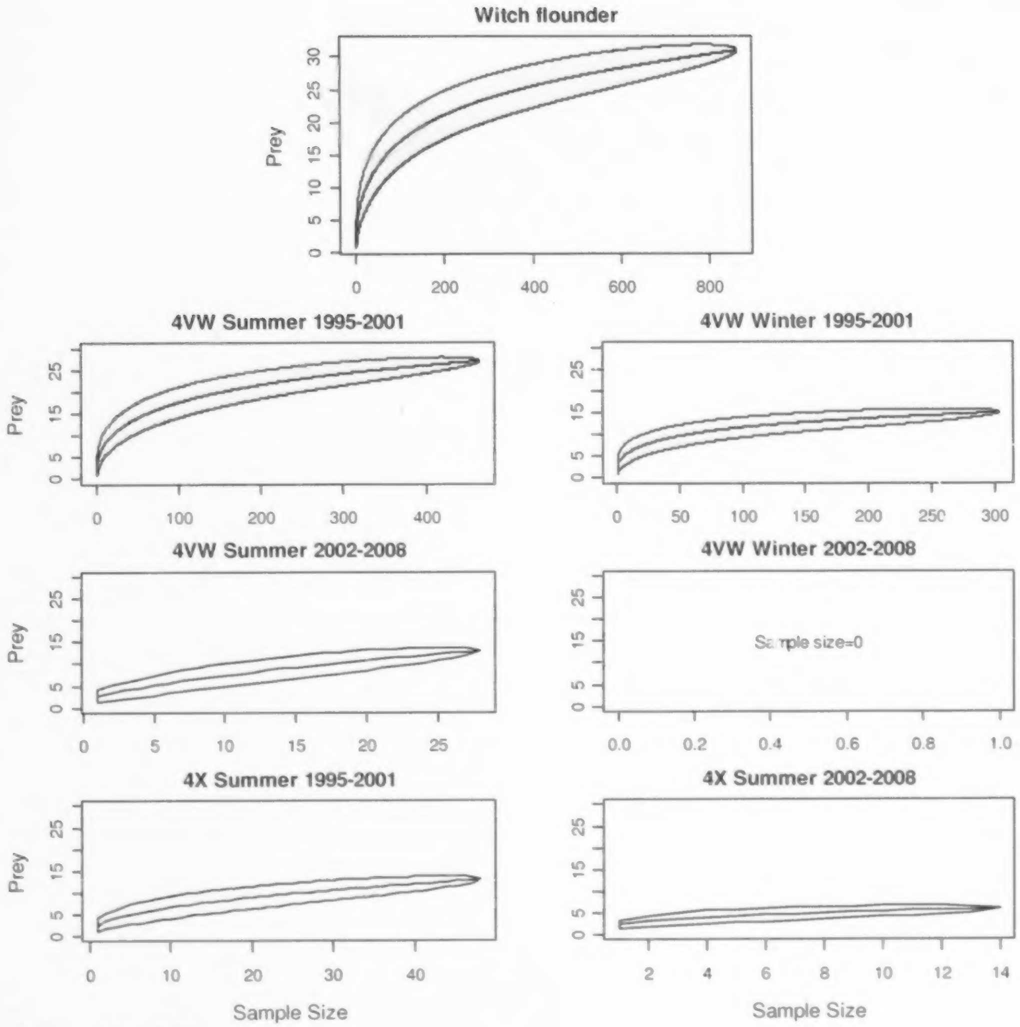

Witch flounder

4VW Summer 1995-2001

4VW Winter 1995-2001

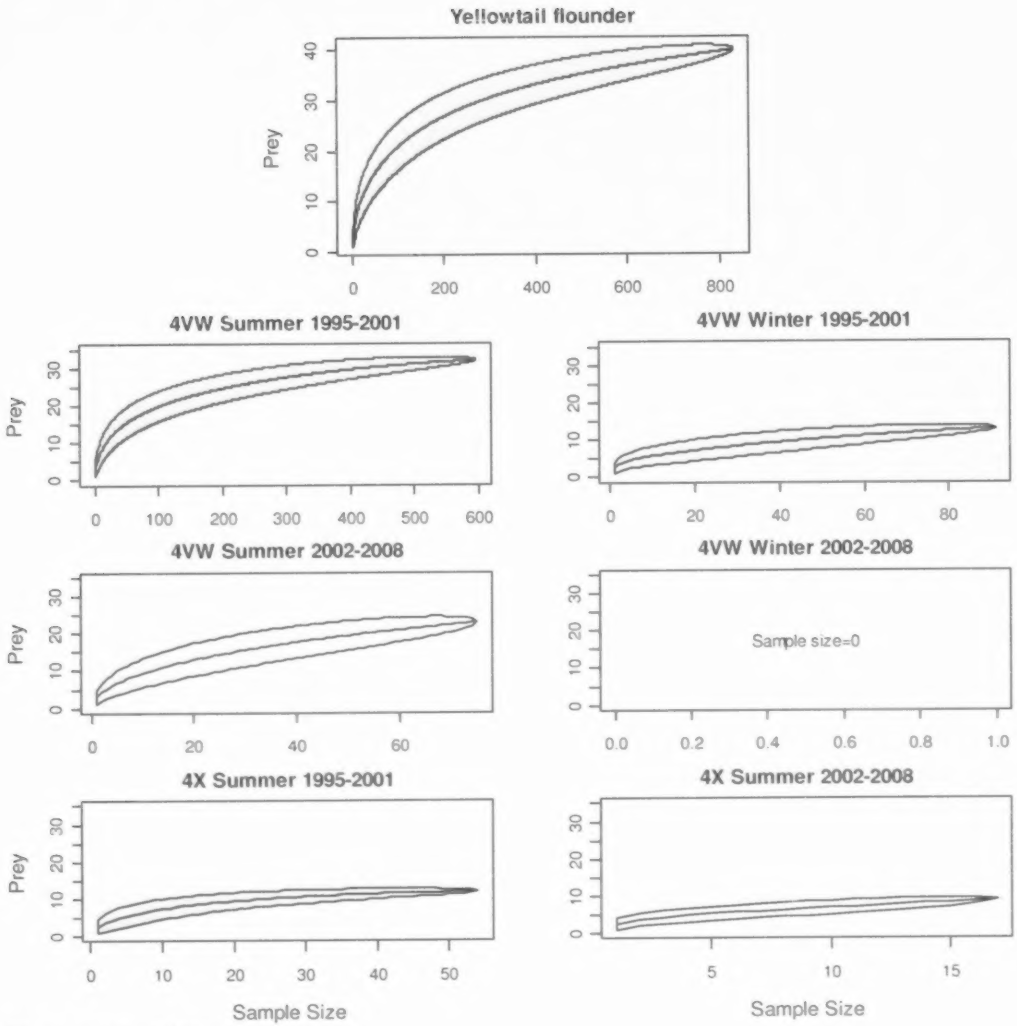
4VW Summer 2002-2008

4VW Winter 2002-2008

4X Summer 1995-2001

4X Summer 2002-2008

Figure A3- GS(cont)



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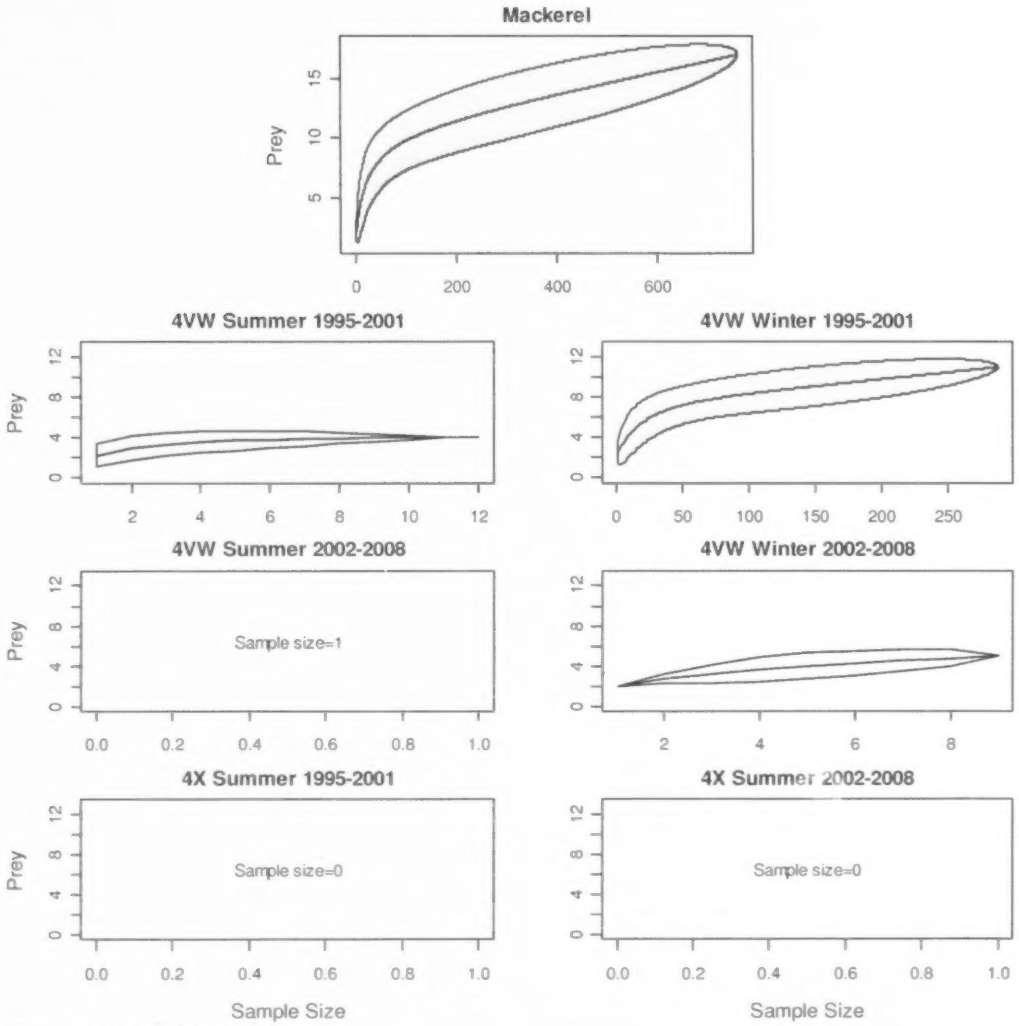

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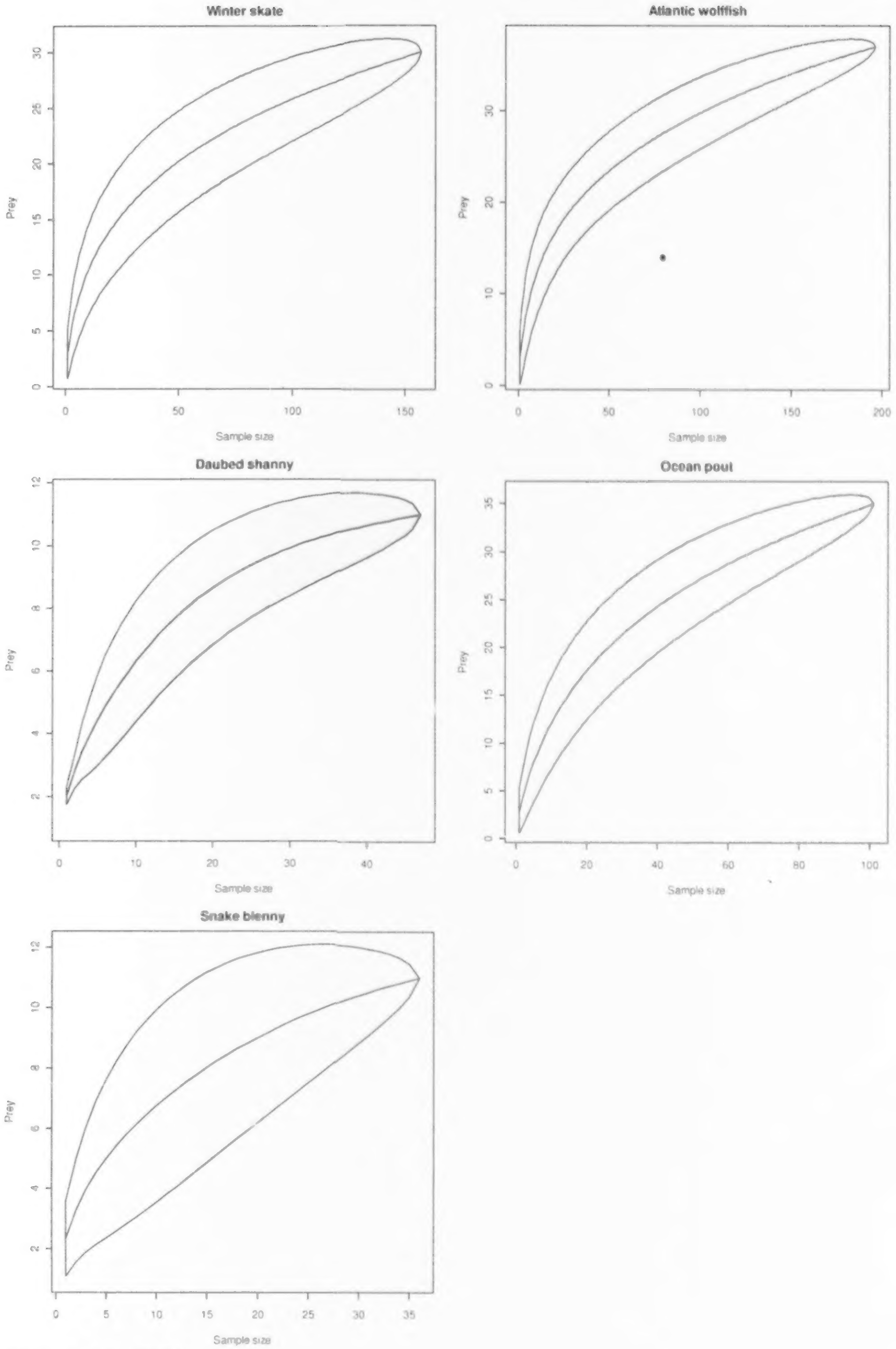

Figure A3- GS(cont)